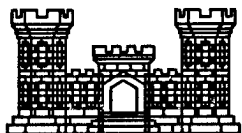


**Water Conservation Study (Water and Energy)  
Energy Engineering Analysis Program (EEAP) FY94S  
Fort Knox, Kentucky**

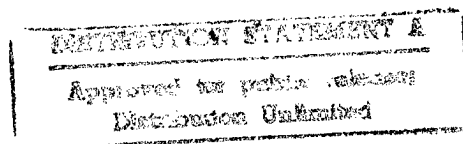
***Final Report***

***Volume 1 of 3***

CONTRACT #DACA01-94-D-0034  
SYSTEMS CORP PROJECT #94013.03  
DECEMBER 30, 1994



**Louisville District-  
US Army Corps  
of Engineers**



**SYSTEMS***corp*

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**SYSTEMS ENGINEERING AND MANAGEMENT CORPORATION**

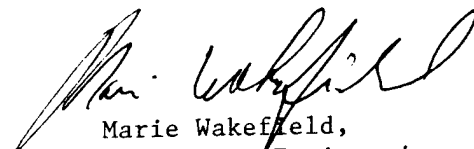


DEPARTMENT OF THE ARMY  
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# 1 EXECUTIVE SUMMARY

FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY

## 1.1 SYNOPSIS

Systems Corp surveyed and completed water and energy analyses for 650 representative buildings at Fort Knox, categorized as unaccompanied personnel housing, community facilities, administrative facilities, maintenance facilities, training facilities, family housing, post laundry, hospital, heating plants, cooling towers, water treatment plants and water distribution systems. The water and energy conservation opportunities (ECOs) evaluated are listed in *Table 1.1*.

Cost estimates were prepared using MeansData for Windows Spreadsheets, Version 2.0a. Life cycle cost analyses were performed using the Life Cycle Cost in Design (LCCID) computer program. Project descriptions and DD1391 forms were prepared for four Energy Conservation Investment Program (ECIP) projects. The total of the four projects that were developed represent \$893K in annual savings and a total discounted savings of \$13.4M in the twenty year life of the projects. The simple paybacks average 5.6 years and the savings to investment (SIR) for the four ECIP projects average 2.8. In addition, three Federal Energy Management Program (FEMP) projects were developed. FEMP Project 1 is the replacement of all of the steam traps in the post laundry with a payback of 0.5 years and an SIR of 40. FEMP Project 2 is heating distribution system manhole repairs with a 3.4 year payback and an SIR of 5.5. FEMP Project 3 is the installation of wells to provide irrigation water for Lindsey and Anderson Greens with a 5.1 year payback and an SIR of 2.9.

## 1.2 INTRODUCTION

Systems Engineering and Management Corporation (Systems/Corp) was contracted by the Louisville District of the United States Army Corps of Engineers in August 1994 to perform a water conservation study of Fort Knox, Kentucky.

### 1.2.1 Scope of Work

1. Evaluate selected water and energy conservation opportunities (ECOs) to determine their water and energy savings potential and economic feasibility.
2. Conduct a limited site survey of selected buildings, family housing, heating plants, cooling towers and water distribution systems to insure any methods of water conservation which are practical and have not been evaluated in any previous study have been considered and the results documented.

TABLE 1.1 SUMMARY OF RECOMMENDED PROJECTS

PROJECT	INITIAL COST (\$)	ENERGY SAVINGS (MWH/HR)	SIMPLE PAYBACK PERIOD (YRS)	SIR	WATER AND MAINTENANCE SAVINGS (\$)
ECIP-FH1: Family Housing Water Conservation Phase 1	887,700	374	5.73	2.61	106,700
ECIP-FH2: Family Housing Water Conservation Phase 2	992,200		5.68	2.61	125,000
ECIP-FH3: Family Housing Water Conservation Phase 3	980,100		6.63	2.24	98,900
ECIP-4: Water Conservation Improvements to 452 Non-Family Housing Buildings	1,712,500	3,150	4.12	3.68	296,600
FEMP-1: Replacement of Steam Traps in Post Laundry	32,900	6,548	0.46	39.92	2,200
FEMP-2: Heating Distribution System Manhole Repairs	247,200	6,935	3.39	5.48	
FEMP-3: Golf Course Irrigation Well System	36,900	-9	5.13	2.90	7,603

## 1 EXECUTIVE SUMMARY

FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY

3. Determine efficiency of existing systems. Determine the replacement options with the highest SIR.
4. Provide complete programming or implementation documentation for all recommended ECOs.
5. Prepare a comprehensive report to document the work performed, the results, and the recommendations.

### 1.2.2 Organization of the Final Report

The submitted material for this report consists of the following:

- Volume I: Executive Summary, Methods and Approach , ECIP Project 1, ECIP Project 2, and ECIP Project 3.
- Volume II: ECIP Project 4.
- Volume III: FEMP Project 1, FEMP Project 2, FEMP Project 3, and Appendices A-D.

### 1.3 PRESENT AND HISTORICAL WATER CONSUMPTION

The baseline water and energy consumption and the water and energy conservation opportunities were evaluated using spreadsheets to calculate water and energy consumption. These have been included in *Section 3 through 9* of this report.

The energy, water and sewage treatment costs used to calculate the savings for the project are as follows:

Cost/MBtu	
Electric	= \$0.02505/KWH or \$25.05/MWH
Fuel Oil	= \$5.05/MBtu or \$17.15/MWH
Natural Gas	= \$3.10/MBtu or \$10.51/MWH
Cost/Kgal	
Water	= \$0.9409/KGAL or \$0.249/Kliter
Sewage	= \$0.6292KGAL or \$0.160/Kliter

## 1 EXECUTIVE SUMMARY

*FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY*

### 1.4 ENERGY CONSERVATION OPPORTUNITIES INVESTIGATED

Systems Corp analyzed sixteen water and energy conservation opportunities (ECOs) at Fort Knox, Kentucky. The analysis was performed utilizing water and energy models developed by Systems Corp and data collected during the field survey of the facilities at Fort Knox. Each ECO was evaluated to determine the potential water and energy savings, dollar savings, implementation costs, simple payback, life cycle cost, and savings to investment ratio (SIR). The sixteen ECOs that were evaluated are as follows:

ECO-1	Spring-Loaded Faucets
ECO-2	Faucet Aerators
ECO-2FH	Faucet Aerators in Family Housing Units
ECO-3	Flush Valves for Water Closets
ECO-3FH	Water Closets in Family Housing Units
ECO-4	Flush Valve Retrofits for Urinals
ECO-5	Water Saving Showerheads
ECO-6	Dining Facility (Kitchen) Retrofits
ECO-7	Golf Course Irrigation
ECO-8	Post Laundry Retrofits
ECO-9	Water Treatment Plants and Well Field Motors and Pumps
ECO-10	Manhole Sump Pump Repairs
ECO-11	Sensor Controls
ECO-12	Water Heater Insulation Blanket
ECO-16	Ozone Treatment of Cooling Tower Water

Systems Corp's water and energy analysis models were used to determine the savings achieved for implementing each ECO in the facilities evaluated. MeansData for Windows Spreadsheets, Version 2.0a cost estimating software was used to estimate the implementation cost of each ECO in each facility evaluated. The U.S. Army Corps of Engineers' Life Cycle Cost in Design, Version 1.0, Level 92, software was used to perform life cycle cost analyses and determine the SIR of each ECO for each facility evaluated.

#### 1.4.1 ECOs Recommended

## 1 EXECUTIVE SUMMARY

*FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY*

Systems Corp recommended both ECOs evaluated be implemented, but not in every area surveyed. The following is a list of the ECOs recommended to be implemented by area surveyed. The criteria for recommendation is a favorable simple payback, and savings to investment ratio (SIR).

ECO-1	Spring-Loaded Faucets
ECO-2	Faucet Aerators
ECO-2FH	Faucet Aerators in Family Housing Units
ECO-3	Flush Valves for Water Closets
ECO-3FH	Water Closets in Family Housing Units
ECO-4	Flush Valve Retrofits for Urinals
ECO-6	Dining Facility (Kitchen) Retrofits
ECO-7	Golf Course Irrigation
ECO-8	Post Laundry Retrofits
ECO-10	Manhole Sump Pump Repairs

### 1.4.2 ECOs Rejected

ECO-9, 11, 12, and 16 were rejected due to the large investment required, the low potential savings, or the existence of a more economically feasible technology. Refer to Appendix D for The Life Cycle Cost Analyses, Cost Estimates and Calculations.

### 1.4.3 ECIP and FEMP Projects Developed

Systems Corp developed four ECIP projects and three FEMP projects (see Table 1.4.3). ECIP Family Housing Project 1 consists of the replacement of water closets in 1354 family housing units with water saving, 6-liters (1.6 gallons)-per-flush water closets, and the installation of faucet aerators in 328 family housing units. ECIP Family Housing Project 2 consists of the replacement of water closets in 1602 family housing units with water saving, 6-liters (1.6 gallons)-per-flush water closets. ECIP Family Housing Project 3 consists of the replacement of water closets in 1268 family housing units with water saving, 6-liters (1.6 gallons)-per-flush water closets. ECIP Project 4 consists of the replacement of flush valves and faucets in 452 buildings with water saving flush valves, metering valve faucets and the installation of faucet aerators. FEMP Project 1 consists of the replacement of all of the steam traps in Building 18, the Post Laundry. FEMP Project 2 consists of the repairs to the heating distribution system manholes for the underground distribution systems serving boiler plants in the following buildings: Buildings 852, 1537, 1725, 1731, 1785, 1797, 2780, 5213, 5943,

## 1 EXECUTIVE SUMMARY

*FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY*

6615 and 7203. FEMP Project 3 consists of disconnecting the existing potable water supplies and drilling two wells, one each for the Lindsey and Anderson golf courses.

## 2 METHODS AND APPROACH

### *FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY*

This section of the report describes the method and approach used by Systems Corp to complete the study. Of primary importance to the successful completion of a project of this magnitude is organization, planning and the ability to quickly document, evaluate and manipulate large amounts of data. This data must then be reduced to useable form which allows for full development of the various projects within the available funding categories. Four Energy Conservation Investment Program (ECIP) projects and three Federal Energy Management Program (FEMP) projects were developed.

#### 2.1 FIELD SURVEY

The field survey as performed by Systems Corp was designed to provide the necessary data required to complete the Scope of Work for this project. It was also designed to provide residual benefits to the installation by providing an organized and readily available source of information which can be used in future years. The information was transmitted in the form of field notes using standardized survey forms.

The survey forms were designed to allow notations of all data which could be utilized (not necessarily required) to calculate the energy savings gained by implementing a specific energy conservation opportunity. These forms contain data obtained from as-built drawings and old energy studies confirmed in the fields as well as data obtained only in the field.

Thorough preparation for the building survey is required to ensure the data required to perform the technical analysis is obtained. The building surveys were performed in a manner which assured the best results. A simple listing of each step of the process best describes our approach to the surveys.

1. The list of Water and Energy Conservation Opportunities (ECOs) included in the work scope were reviewed in detail.
2. Each ECO was given an identification number which is used consistently throughout this project.
3. An expanded description of each ECO was formulated to outline the possible methods for implementation of the ECO.
4. Survey forms were developed for each ECO to provide space to enter any data which might possibly be used in performing the engineering and economic analysis of the ECO.
5. The building surveys were performed. Measurements of existing flow rates were made.
6. The Systems Corp survey team met with the post Energy Officer throughout the survey on an as-needed basis.

## 2 METHODS AND APPROACH

### FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY

#### 2.1.1 Energy and Water Conservation Opportunities

The Systems Corp's Water and Energy Conservation Team gathered field data and evaluated 18 distinct energy conservation opportunities. The energy conservation opportunities are listed following table:

TABLE 2.1.1 Energy/Water Conservation Opportunities	
ECO - 1	Spring Loaded Faucets
ECO - 2	Faucet Aerators
ECO - 2FH	Faucet Aerators
ECO - 3	Flush Valve Replacements for Water Closets
ECO - 3FH	Water Closet Replacement
ECO - 4	Flush Valve Replacements for Urinals
ECO - 5	Water Saving Showerheads
ECO - 6	Dining Facilities Kitchen Areas
ECO - 7	Golf Course Irrigation
ECO - 8	Post Laundry
ECO - 9	Waste Treatment Plants and Well Fields, Motors, and Pumps
ECO - 10	Manhole Sump Pump Repairs
ECO - 11	Sensor Controls for Faucets
ECO - 12	Water Heater Insulation Blankets
ECO - 13	Distribution Waterline Motors, Valves, Leaks, Storage Towers and Tanks, Off Peak, and Capacities
ECO - 14	Hospital, Process Cooling, i.e. X-ray and CAT scan Equipment, and Leaks
ECO - 15	Vehicle Wash Facilities
ECO - 16	Cooling Towers at Hospital

## 2 METHODS AND APPROACH

### FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY

#### 2.1.2 Energy and Water Conservation Opportunities That Were Not Evaluated

Systems Corp's Water and Energy Conservation Team surveyed all facilities before any determination of the applicability of the energy conservation opportunity was made. After completing the field survey, ECO-13, ECO-14, ECO-15 and ECO-16 were discarded.

##### 2.1.2.1 ECO-5 Water Saving Showerheads

During the field survey, it was determined that water saving 2.5 gpm showerheads were already in place. The ECO was discarded.

##### 2.1.2.2 ECO-13 Distribution Waterlines, Motors, Valves, Leaks, Storage Towers and Tanks, Off Peak and Capacities

All pump motors were evaluated under ECO-9. No distribution leaks were discovered during the survey. In addition, Fort Knox Directorate of Public Works, Operation and Maintenance Personnel were interviewed to learn of any likely areas where distribution water lines were suspect. The new water storage tank project plans and specifications were reviewed. The post's electrical demand profile and water treatment plant recorder charts were reviewed to determine the impact of water pumps on electric demand charges. Comparison of the data showed that peak water demand did not coincide with peak electrical demand periods. The ECO was discarded after completing these review steps.

##### 2.1.2.3 ECO-14 Hospital Process Cooling

ECO-14 Hospital Process Cooling pertained to the use of potable water to perform cooling of X-ray, CAT scan, dialysis or medical equipment and any associated leaks. An extensive survey of Ireland Army Community Hospital was completed with excellent cooperation and assistance from the Hospital staff. No instances were found where potable water was being used to perform process cooling. Since no water saving opportunities relating to process cooling or any associated leaks were found, ECO-14 was eliminated.

##### 2.1.2.4 ECO-15 Vehicle Wash Facilities

ECO-15 Vehicle Wash Facilities pertained to water saving opportunities relating to vehicle washing systems. The vehicle wash facilities are located adjacent to Building 7233 and at the intersection of Wilson Road and Frazier Road. The wash systems were found to be using rain water only which is

## 2 METHODS AND APPROACH

### FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY

recycled after each use. No water conservation opportunities were found, and ECO-15 was eliminated.

#### 2.1.3 Buildings Not Evaluated

The scope of work delineates which energy conservation opportunities are to be evaluated for buildings in each category code. A real property list, sorted by category code, was appended to the scope of work. The following tables list the buildings included in the real property list for which no energy conservation opportunities were evaluated. The title of each table describes the reason that no energy conservation opportunities were evaluated for the buildings in each list.

*Table 2.1.3.1* is a listing of all of the buildings that were included in the real property listing, sorted by category codes, that do not have water service.

*Table 2.1.3.2* is a listing of all of the buildings that were included in the real property listing, sorted by category codes, that are abandoned or not occupied.

*Table 2.1.3.3* is a listing of all of the buildings that were included in the real property listing, sorted by category codes, that no longer exist.

*Table 2.1.3.4* is a listing of all the buildings that were included in the real property listing, sorted by category codes, that are not located at Fort Knox.

*Table 2.1.3.5* is a listing of all the buildings that were included in the real property listing, sorted by category codes, and are non-appropriated fund facilities (AAFES).

Refer to the following tables:

*Table 2.1.3.1 Buildings Without Water - No ECOs Evaluated*

*Table 2.1.3.2 Buildings Abandoned or Not Occupied - No ECOs Evaluated*

*Table 2.1.3.3 Buildings That No Longer Exist - No ECOs Evaluated*

*Table 2.1.3.4 Buildings That Are Not Located at Fort Knox - No ECOs Evaluated*

*Table 2.1.3.5 Non-Appropriated Fund Facilities - No ECOs Evaluated*

TABLE 2.1.3.1 BUILDINGS WITHOUT WATER -  
NO ECOs EVALUATED

CATEGORY		CATEGORY/DESCRIPTION	AREA (SQ FT)	YEAR
17120	01526	GEN INST BLDG	4078	1958
17120	06286	GEN INST BLDG	1496	1987
17120	06287	GEN INST BLDG	1496	1987
17120	06288	GEN INST BLDG	1496	1987
17120	09332	GEN INST BLDG	1000	1962
17120	09349	GEN INST BLDG	1000	1962
17120	09460	GEN INST BLDG	597	1960
17120	09474	GEN INST BLDG	992	1962
17120	09509	GEN INST BLDG	144	1985
17120	09643	GEN INST BLDG	1038	1977
17120	09745	GEN INST BLDG	578	1986
17120	09746	GEN INST BLDG	578	1986
17120	09747	GEN INST BLDG	578	1985
17120	09748	GEN INST BLDG	578	1986
17120	09749	GEN INST BLDG	578	1986
17120	09760	GEN INST BLDG	800	1988
17120	09761	GEN INST BLDG	800	1988
17122	06035	RG HOUSE	2830	1988
17122	09346	RG HOUSE	180	1965
17122	09355	RG HOUSE	160	1982
17122	09381	RG HOUSE	75	1987
17122	09382	RG HOUSE	54	1987
17122	09712	RG HOUSE	558	1983
17122	09713	RG HOUSE	558	1983
17122	09715	RG HOUSE	558	1983
17122	09716	RG HOUSE	558	1983
17122	09717	RG HOUSE	366	1983
17122	09718	RG HOUSE	366	1983
17122	09719	RG HOUSE	366	1983
17122	09720	RG HOUSE	366	1983
17122	09722	RG HOUSE	558	1983
17122	09723	RG HOUSE	558	1983
17123	09219	RANGE SPT BLDG	800	1960
17123	09340	RANGE SPT BLDG	1800	1965
17123	09344	RANGE SPT BLDG	1800	1965
17123	09376	RANGE SPT BLDG	108	1985
17123	09377	RANGE SPT BLDG	108	1985
17123	09379	RANGE SPT BLDG	54	1985
17123	09380	RANGE SPT BLDG	108	1985
17123	09384	RANGE SPT BLDG	2165	1987
17123	09463	RANGE SPT BLDG	3200	1970
17123	09609	RANGE SPT BLDG	69	1977
17123	09755	RANGE SPT BLDG	120	1988
17123	09763	RANGE SPT BLDG	120	1988
17130	09175	APPL INST BLDG	800	1983
17139	02387	COVD TRNG AREA	200	1977
17139	02792	COVD TRNG AREA	320	1976
17139	06915	COVD TRNG AREA	1056	1983

TABLE 2.1.3.1 BUILDINGS WITHOUT WATER -  
NO ECOs EVALUATED

CATEGORY		CATEGORY/DESCRIPTION	AREA (SQ FT)	YEAR
17139	09399	COVD TRNG AREA	613	1984
17139	09462	COVD TRNG AREA	1212	1980
17139	09602	COVD TRNG AREA	840	1977
17139	09610	COVD TRNG AREA	803	1977
17139	09620	COVD TRNG AREA	3648	1977
17139	09623	COVD TRNG AREA	757	1977
17139	09625	COVD TRNG AREA	392	1977
17139	09627	COVD TRNG AREA	757	1977
17139	09631	COVD TRNG AREA	776	1977
17139	09633	COVD TRNG AREA	776	1977
17139	09634	COVD TRNG AREA	840	1977
17139	09637	COVD TRNG AREA	845	1977
17139	09646	COVD TRNG AREA	650	1977
17139	09647	COVD TRNG AREA	650	1977
17139	09665	COVD TRNG AREA	780	1977
17139	09673	COVD TRNG AREA	574	1977
17139	09759	COVD TRNG AREA	984	1988
17139	09762	COVD TRNG AREA	984	1988
17139	09780	COVD TRNG AREA	992	1988
17139	09781	COVD TRNG AREA	992	1988
17139	09782	COVD TRNG AREA	992	1988
17139	09786	COVD TRNG AREA	992	1988
17170	07106	GAS CHAMBER	1392	1969
17190	09292	OTHER	144	1970
17190	09459	OTHER	64	1970
17190	09502	OTHER	256	1987
17190	09600	OTHER	18	1977
17190	09601	OTHER	69	1977
17190	09603	OTHER	69	1977
17190	09604	OTHER	69	1977
17190	09605	OTHER	69	1977
17190	09607	OTHER	69	1977
17190	09608	OTHER	67	1977
17190	09611	OTHER	69	1977
17190	09612	OTHER	69	1977
17190	09613	OTHER	81	1977
17190	09615	OTHER	81	1977
17190	09616	OTHER	26	1977
17190	09622	OTHER	69	1977
17190	09624	OTHER	69	1977
17190	09626	OTHER	69	1977
17190	09628	OTHER	128	1983
17190	09630	OTHER	69	1977
17190	09632	OTHER	69	1977
17190	09635	OTHER	69	1977
17190	09636	OTHER	69	1977
17190	09638	OTHER	72	1977
17190	09644	OTHER	39	1977

TABLE 2.1.3.1 BUILDINGS WITHOUT WATER -  
NO ECOS EVALUATED

CATEGORY		CATEGORY/DESCRIPTION	AREA (SQ FT)	YEAR
17190	09645	OTHER	54	1977
17190	09649	OTHER	36	1977
17190	09652	OTHER	26	1977
17190	09653	OTHER	26	1977
17190	09654	OTHER	26	1977
17190	09656	OTHER	64	1977
17190	09659	OTHER	64	1977
17190	09663	OTHER	64	1977
17190	09664	OTHER	49	1977
17190	09670	OTHER	35	1977
17190	09707	OTHER	88	1983
17190	09708	OTHER	558	1983
17190	09709	OTHER	558	1983
17190	09711	OTHER	88	1983
17190	09714	OTHER	88	1983
17190	09721	OTHER	88	1983
17190	09752	OTHER	32	1988
17190	09756	OTHER	114	1983
17190	09766	OTHER	114	1983
17190	09787	OTHER	72	1988
17190	09788	OTHER	72	1988
21420	07339	VEH MNT SH DS	2000	1962
21459	02738	OC&L FAC COV		1989
21459	02739	OC&L FAC COV		1989
21470	02753	OIL STO BLDG	120	1964
21470	02773	OIL STO BLDG	120	1964
21470	02776	OIL STO BLDG	120	1964
21470	02777	OIL STO BLDG	120	1964
21470	02779	OIL STO BLDG	120	1964
21470	02784	OIL STO BLDG	120	1964
21470	02791	OIL STO BLDG	120	1969
21470	02965	OIL STO BLDG	120	1969
21470	02966	OIL STO BLDG	120	1969
21470	06124	OIL STO BLDG	120	1965
21470	06594	OIL STO BLDG	120	1968
21470	06596	OIL STO BLDG	120	1968
72321	02990	DET LATRINE BDG	70	1966
72321	04124	DET LATRINE BDG	138	1964
72321	06528	DET LATRINE BDG	150	1987
72321	07237	DET LATRINE BDG	178	1987
72321	09185	DET LATRINE BDG	72	1979
72321	09204	DET LATRINE BDG	178	1960
72321	09205	DET LATRINE BDG	178	1960
72321	09208	DET LATRINE BDG	178	1961
72321	09224	DET LATRINE BDG	178	1964
72321	09231	DET LATRINE BDG	178	1960
72321	09232	DET LATRINE BDG	178	1960
72321	09233	DET LATRINE BDG	178	1960

TABLE 2.1.3.1 BUILDINGS WITHOUT WATER -  
NO ECOs EVALUATED

CATEGORY		CATEGORY/DESCRIPTION	AREA (SQ FT)	YEAR
72321	09234	DET LATRINE BDG	178	1961
72321	09235	DET LATRINE BDG	178	1961
72321	09236	DET LATRINE BDG	178	1961
72321	09237	DET LATRINE BDG	167	1966
72321	09239	DET LATRINE BDG	178	1961
72321	09240	DET LATRINE BDG	178	1961
72321	09241	DET LATRINE BDG	178	1961
72321	09242	DET LATRINE BDG	178	1961
72321	09254	DET LATRINE BDG	178	1963
72321	09256	DET LATRINE BDG	178	1963
72321	09258	DET LATRINE BDG	178	1963
72321	09264	DET LATRINE BDG	179	1972
72321	09265	DET LATRINE BDG	178	1961
72321	09270	DET LATRINE BDG	178	1961
72321	09273	DET LATRINE BDG	178	1961
72321	09274	DET LATRINE BDG	178	1961
72321	09275	DET LATRINE BDG	178	1962
72321	09276	DET LATRINE BDG	178	1961
72321	09282	DET LATRINE BDG	178	1961
72321	09284	DET LATRINE BDG	178	1961
72321	09286	DET LATRINE BDG	178	1961
72321	09290	DET LATRINE BDG	178	1961
72321	09302	DET LATRINE BDG	178	1963
72321	09305	DET LATRINE BDG	16	1972
72321	09315	DET LATRINE BDG	178	1966
72321	09316	DET LATRINE BDG	178	1963
72321	09317	DET LATRINE BDG	178	1963
72321	09318	DET LATRINE BDG	178	1963
72321	09322	DET LATRINE BDG	178	1963
72321	09323	DET LATRINE BDG	16	1972
72321	09324	DET LATRINE BDG	16	1972
72321	09325	DET LATRINE BDG	178	1963
72321	09328	DET LATRINE BDG	16	1972
72321	09330	DET LATRINE BDG	178	1963
72321	09335	DET LATRINE BDG	178	1966
72321	09342	DET LATRINE BDG	178	1965
72321	09347	DET LATRINE BDG	171	1966
72321	09350	DET LATRINE BDG	178	1969
72321	09351	DET LATRINE BDG	178	1969
72321	09352	DET LATRINE BDG	178	1969
72321	09353	DET LATRINE BDG	178	1969
72321	09358	DET LATRINE BDG	180	1964
72321	09360	DET LATRINE BDG	178	1964
72321	09361	DET LATRINE BDG	16	1978
72321	09362	DET LATRINE BDG	16	1978
72321	09363	DET LATRINE BDG	16	1978
72321	09364	DET LATRINE BDG	16	1978
72321	09365	DET LATRINE BDG	16	1978

TABLE 2.1.3.1 BUILDINGS WITHOUT WATER -  
NO ECOs EVALUATED

CATEGORY		CATEGORY/DESCRIPTION	AREA (SQ FT)	YEAR
72321	09366	DET LATRINE BDG	16	1978
72321	09367	DET LATRINE BDG	16	1978
72321	09395	DET LATRINE BDG	178	1967
72321	09396	DET SHOWER BLDG	920	1987
72321	09467	DET LATRINE BDG	192	1970
72321	09471	DET LATRINE BDG	192	1970
72321	09472	DET LATRINE BDG	192	1970
72321	09475	DET LATRINE BDG	178	1970
72321	09476	DET LATRINE BDG	178	1970
72321	09477	DET LATRINE BDG	178	1970
72321	09479	DET LATRINE BDG	179	1979
72321	09606	DET LATRINE BDG	168	1977
72321	09619	DET LATRINE BDG	168	1977
72321	09621	DET LATRINE BDG	177	1977
72321	09660	DET LATRINE BDG	187	1977
72321	09661	DET LATRINE BDG	187	1977
72321	09671	DET LATRINE BDG	264	1977
72321	09674	DET LATRINE BDG	179	1985
72321	09675	DET LATRINE BDG	220	1979
72321	09676	DET LATRINE BDG	220	1979
72321	09677	DET LATRINE BDG	220	1979
72321	09678	DET LATRINE BDG	220	1979
72321	09679	DET LATRINE BDG	220	1979
72321	09680	DET LATRINE BDG	220	1979
72321	09681	DET LATRINE BDG	220	1979
72321	09682	DET LATRINE BDG	220	1979
72321	09683	DET LATRINE BDG	220	1979
72321	09684	DET LATRINE BDG	220	1979
72321	09685	DET LATRINE BDG	220	1979
72321	09686	DET LATRINE BDG	220	1979
72321	09687	DET LATRINE BDG	220	1979
72321	09688	DET LATRINE BDG	220	1979
72321	09689	DET LATRINE BDG	220	1979
72321	09690	DET LATRINE BDG	220	1979
72321	09691	DET LATRINE BDG	220	1979
72321	09692	DET LATRINE BDG	220	1979
72321	09693	DET LATRINE BDG	220	1979
72321	09694	DET LATRINE BDG	220	1979
72321	09695	DET LATRINE BDG	220	1979
72321	09696	DET LATRINE BDG	220	1979
72321	09697	DET LATRINE BDG	220	1979
72321	09698	DET LATRINE BDG	220	1979
72321	09699	DET LATRINE BDG	220	1979
72321	09700	DET LATRINE BDG	220	1979
72321	09701	DET LATRINE BDG	220	1979
72321	09702	DET LATRINE BDG	220	1979
72321	09703	DET LATRINE BDG	220	1979
72321	09704	DET LATRINE BDG	220	1979

TABLE 2.1.3.1 BUILDINGS WITHOUT WATER -  
NO ECOs EVALUATED

CATEGORY		CATEGORY/DESCRIPTION	AREA (SQ FT)	YEAR
72321	09705	DET LATRINE BDG	133	1983
72321	09706	DET LATRINE BDG	133	1983
72321	09751	DET LATRINE BDG	180	1988
72321	09757	DET LATRINE BDG	199	1988
72321	09758	DET LATRINE BDG	199	1988
72321	09764	DET LATRINE BDG	199	1988
72321	09765	DET LATRINE BDG	199	1988
72350	00858	DETACH GARAGES	780	1980
72350	01008	DETACH GARAGES	2131	1941
73055	00128	WAITING SHELTER	62	1981
73055	01305	WAITING SHELTER	62	1981
73055	01381	WAITING SHELTER	62	1981
73055	01502	WAITING SHELTER	62	1981
73055	02440	WAITING SHELTER	62	1981
73055	02652	WAITING SHELTER	62	1981
73055	02813	WAITING SHELTER	60	1963
73055	04025	WAITING SHELTER	362	1936
73055	04112	WAITING SHELTER	120	1956
73055	04120	WAITING SHELTER	120	1956
73055	04122	WAITING SHELTER	120	1956
73055	04123	WAITING SHELTER	144	1970
73055	04125	WAITING SHELTER	120	1966
73055	04126	WAITING SHELTER	120	1966
73055	05914	WAITING SHELTER	62	1981
73055	05945	WAITING SHELTER	62	1981
73055	06651	WAITING SHELTER	62	1981
73055	06757	WAITING SHELTER	62	1981
73055	06766	WAITING SHELTER	180	1960
73055	07343	WAITING SHELTER	60	1963
73055	07950	WAITING SHELTER	137	1966
73055	07951	WAITING SHELTER	137	1966
73055	07952	WAITING SHELTER	137	1966
73055	09182	WAITING SHELTER	72	1980
73055	09249	WAITING SHELTER	192	1963
73055	09503	WAITING SHELTER	48	1985
73055	09504	WAITING SHELTER	48	1985
73055	09505	WAITING SHELTER	48	1985
73055	09506	WAITING SHELTER	48	1985
73055	09507	WAITING SHELTER	48	1985
73055	09508	WAITING SHELTER	48	1985
73072	04770	PO BRANCH	859	1958
73075	07725	PUBLIC TOILET	312	1972
73090	07712	OTHER	0	1989
74025	01171	ACES FACILITY	4460	1973
74025	01172	ACES FACILITY	4460	1973
74031	04011	GOLF COURSE MNT	3800	1985
74031	09021	GOLF COURSE MNT	664	1941
74049	07718	RIDING STABLE	2558	1941

TABLE 2.1.3.1 BUILDINGS WITHOUT WATER -  
NO ECOS EVALUATED

CATEGORY		CATEGORY/DESCRIPTION	AREA (SQ FT)	YEAR
74049	07719	RIDING STABLE	3204	1918
74049	07724	RIDING STABLE	2558	1940
74049	07726	RIDING STABLE	2555	1938
74049	07727	RIDING STABLE	2510	1938
74049	09022	RIDING STABLE	5168	1941
74062	04128	SNACK BAR	144	1979
74069	00542	RECREATION BLDG	1144	1941
74069	00544	RECREATION BLDG	1144	1941
74069	00546	RECREATION BLDG	1144	1941
74069	09191	RECREATION BLDG	569	1972
74069	09192	RECREATION BLDG	569	1972
74069	09193	RECREATION BLDG	569	1972
74069	09194	RECREATION BLDG	569	1972
74069	09195	RECREATION BLDG	569	1969
74069	09196	RECREATION BLDG	569	1969
74069	09197	RECREATION BLDG	628	1969
74069	09198	RECREATION BLDG	569	1969
74069	09199	RECREATION BLDG	3018	1969
74090	07713	OTHER	72	1988
82116	00601	HEAT PL BLDG	405	1941
82116	07033	HEAT PL BLDG	359	1941
82150	07203	STEAM PL POWER	13674	1986
84150	09187	CHLORINATOR BLDG	48	1972
84220	09213	WATER PUMP P		1942

TABLE 2.1.3.2 BUILDINGS ABANDONED OR NOT OCCUPIED  
NO ECOS EVALUATED

CATEGORY	BLDG	CATEGORY/DESCRIPTION	AREA (SQ FT)	YEAR
17120	00265	GEN INST BLDG	3158	1941
17120	01011	GEN INST BLDG	1843	1941
17120	01501	GEN INST BLDG	3871	1943
17120	01526	GEN INST BLDG	4078	1958
17120	06682	GEN INST BLDG	2892	1941
17150	06763	BN CLASSROOMS	3547	1953
21410	00160	VEH MNT SH ORG	3427	1942
21420	00578	VEH MNT SH DS	2728	1942
21420	00579	VEH MNT SH DS	2728	1942
21420	00584	VEH MNT SH DS	8208	1943
21420	07330	VEH MNT SH DS	4687	1942
21420	07331	VEH MNT SH DS	4687	1942
21420	07340	VEH MNT SH DS	4687	1942
17120	00580	VEH MNT SH DS	2728	1942
17120	07341	VEH MNT SH DS	3560	1942
17120	07423	VEH MNT SH DS	4687	1942
72114	00703	ENL BKS AN TR	4720	1941
72114	00704	ENL BKS AN TR	4720	1941
72114	00705	ENL BKS AN TR	4720	1941
72114	00801	ENL BKS AN TR	4720	1941
72114	00802	ENL BKS AN TR	4720	1941
72114	00804	ENL BKS AN TR	4720	1941
72114	00809	ENL BKS AN TR	4720	1941
72114	00811	ENL BKS AN TR	4720	1941
72114	00812	ENL BKS AN TR	4720	1941
72114	00816	ENL BKS AN TR	4720	1941
72114	00817	ENL BKS AN TR	4720	1941
72114	00819	ENL BKS AN TR	4720	1941
72114	00824	ENL BKS AN TR	4720	1941
72114	00826	ENL BKS AN TR	4720	1941
72114	00827	ENL BKS AN TR	4883	1941
72114	00831	ENL BKS AN TR	4720	1941
72114	00836	ENL BKS AN TR	4720	1941
72114	00839	ENL BKS AN TR	4720	1941
72114	07385	ENL BKS AN TR	4720	1941
72114	07388	ENL BKS AN TR	4720	1941
72114	07391	ENL BKS AN TR	4720	1941
72114	07396	ENL BKS AN TR	4720	1985
72210	07386	EN PERS DINE	2500	1942
72220	02442	OFF FR DINE FAC	10977	1962
17123	06677	DET DAY ROOM	2892	1941
17123	06678	DET DAY ROOM	0	1941
73018	00887	RELG EDUC FAC	1200	1973
73019	00888	UNIT CHAPEL	3765	1942
73025	02321	PASTRY KITCHEN	7733	1938
74025	01023	ACES FACILITY	1296	1941
74027	06645	OPEN DIN NCO	9525	1943
74027	07375	DRAMA CENTER	22746	1940

TABLE 2.1.3.2 BUILDINGS ABANDONED OR NOT OCCUPIED  
NO ECOS EVALUATED

CATEGORY	BLDG	CATEGORY/DESCRIPTION	AREA (SQ FT)	YEAR
74066	01338	YOUTH CENTER	8611	1930
74069	00820	RECREATION BLDG	1144	1941
74069	00822	RECREATION BLDG	1144	1941
74069	00833	RECREATION BLDG	1144	1941
74069	05020	RECREATION BLDG	4569	1943
74069	06626	RECREATION BLDG	4320	1942

TABLE 2.1.3.3 BUILDINGS THAT NO LONGER EXIST  
NO ECOS EVALUATED

CATEGORY	BLDG	CATEGORY_DESCR	AREA (SQ FT)	YEAR
17120	00224	GEN INST BLDG	1676	1942
17120	00727	GEN INST BLDG	2360	1941
17120	02710	GEN INST BLDG	3246	1941
17120	02713	GEN INST BLDG	3246	1941
17120	02718	GEN INST BLDG	4720	1941
17120	02719	GEN INST BLDG	4720	1941
17120	07311	GEN INST BLDG	3108	1942
17130	00707	APPL INST BLDG	3380	1941
17130	00745	APPL INST BLDG	3548	1953
17130	00746	APPL INST BLDG	3548	1953
21410	00159	VEH MNT SH ORG	20833	1942
21920	04066	FE FACILITY	2250	1942
72114	00570	ENL BKS AN TR	4720	1941
72114	00617	ENL BKS AN TR	4720	1942
72114	00620	ENL BKS AN TR	4720	1942
72114	00621	ENL BKS AN TR	4720	1941
72114	00622	ENL BKS AN TR	4720	1941
72114	00624	ENL BKS AN TR	4720	1941
72114	00625	ENL BKS AN TR	4720	1941
72114	00626	ENL BKS AN TR	4720	1941
72114	00627	ENL BKS AN TR	4720	1941
72114	00628	ENL BKS AN TR	4720	1941
72114	00630	ENL BKS AN TR	4720	1941
72114	00645	ENL BKS AN TR	4720	1941
72114	00646	ENL BKS AN TR	4720	1941
72114	00647	ENL BKS AN TR	4720	1941
72114	00648	ENL BKS AN TR	4720	1941
72114	00649	ENL BKS AN TR	4720	1941
72114	00650	ENL BKS AN TR	4720	1941
72114	00651	ENL BKS AN TR	4720	1941
72114	00652	ENL BKS AN TR	4720	1941
72114	00659	ENL BKS AN TR	4720	1941
72114	00660	ENL BKS AN TR	4720	1941
72114	00661	ENL BKS AN TR	4720	1941
72114	00665	ENL BKS AN TR	4720	1941
72114	00666	ENL BKS AN TR	4720	1941
72114	00667	ENL BKS AN TR	4720	1941
72114	00668	ENL BKS AN TR	4720	1941
72114	00669	ENL BKS AN TR	4720	1941
72114	00683	ENL BKS AN TR	4720	1941
72114	00685	ENL BKS AN TR	4720	1941
72114	00686	ENL BKS AN TR	4720	1941
72114	00687	ENL BKS AN TR	4720	1941
72114	00688	ENL BKS AN TR	4720	1941
72114	00717	ENL BKS AN TR	4720	1941
72114	00726	ENL BKS AN TR	4720	1941
72114	00728	ENL BKS AN TR	4720	1941
72114	00729	ENL BKS AN TR	4720	1941

TABLE 2.1.3.3 BUILDINGS THAT NO LONGER EXIST  
NO ECOs EVALUATED

CATEGORY	BLDG	CATEGORY_DESCR	AREA (SQ FT)	YEAR
72114	02705	ENL BKS AN TR	4720	1941
72114	02706	ENL BKS AN TR	4720	1941
72114	02707	ENL BKS AN TR	4720	1941
72114	02709	ENL BKS AN TR	4720	1941
72114	02832	ENL BKS AN TR	4720	1941
72114	02844	ENL BKS AN TR	4720	1941
72114	02847	ENL BKS AN TR	4720	1941
72114	02850	ENL BKS AN TR	4720	1941
72114	02853	ENL BKS AN TR	4720	1941
72114	02855	ENL BKS AN TR	4720	1941
72114	02858	ENL BKS AN TR	4720	1941
72114	02859	ENL BKS AN TR	4720	1941
72114	02861	ENL BKS AN TR	4720	1941
72114	02864	ENL BKS AN TR	4720	1941
72114	02865	ENL BKS AN TR	4720	1941
72114	02866	ENL BKS AN TR	4720	1941
72114	02870	ENL BKS AN TR	4720	1941
72114	02871	ENL BKS AN TR	4720	1941
72114	02874	ENL BKS AN TR	4720	1941
72114	02875	ENL BKS AN TR	4720	1941
72114	02878	ENL BKS AN TR	4720	1941
72114	02879	ENL BKS AN TR	4720	1941
72114	02882	ENL BKS AN TR	4720	1941
72114	02883	ENL BKS AN TR	4720	1941
72114	02886	ENL BKS AN TR	4720	1941
72114	02887	ENL BKS AN TR	4720	1941
72114	02890	ENL BKS AN TR	4720	1941
72114	02891	ENL BKS AN TR	4720	1941
72114	02893	ENL BKS AN TR	4720	1941
72114	02894	ENL BKS AN TR	4720	1941
72114	02903	ENL BKS AN TR	4720	1941
72114	02904	ENL BKS AN TR	4720	1941
72114	02905	ENL BKS AN TR	4720	1941
72114	02915	ENL BKS AN TR	4720	1941
72114	02916	ENL BKS AN TR	4720	1941
72114	02922	ENL BKS AN TR	4720	1941
72114	02923	ENL BKS AN TR	4720	1941
72114	02929	ENL BKS AN TR	4720	1941
72114	02945	ENL BKS AN TR	4720	1941
72114	04067	ENL BKS AN TR	4720	1941
72114	05001	ENL BKS AN TR	4720	1941
72114	05002	ENL BKS AN TR	4720	1941
72114	05004	ENL BKS AN TR	4720	1941
72114	07303	ENL BKS AN TR	4720	1941
72114	07304	ENL BKS AN TR	4720	1941
72114	07305	ENL BKS AN TR	4720	1941
72114	07306	ENL BKS AN TR	4720	1941
72114	07307	ENL BKS AN TR	4720	1941

TABLE 2.1.3.3 BUILDINGS THAT NO LONGER EXIST  
NO ECOs EVALUATED

CATEGORY	BLDG	CATEGORY_DESCR	AREA (SQ FT)	YEAR
72114	07313	ENL BKS AN TR	4720	1941
72114	07397	ENL BKS AN TR	4720	1941
72181	02708	ENL BKS BASIC	4720	1941
72210	00629	EN PERS DINE	2360	1951
72210	00642	EN PERS DINE	2650	1951
72210	00644	EN PERS DINE	3100	1942
72210	00656	EN PERS DINE	2650	1942
72210	00675	EN PERS DINE	2360	1941
72210	00677	EN PERS DINE	2360	1941
72210	00718	EN PERS DINE	2631	1942
72210	00803	EN PERS DINE	2372	1951
72210	00818	EN PERS DINE	2208	1942
72210	00830	EN PERS DINE	2208	1941
72210	02849	EN PERS DINE	2360	1941
72210	07308	EN PERS DINE	3250	1951
72360	00623	DET DAY ROOM	2360	1941
72360	00623	DET DAY ROOM	2527	1941
72411	04060	OFF QTR TRANS	7670	1941
72411	04061	OFF QTR TRANS	7670	1941
72411	04062	OFF QTR TRANS	7670	1941
72411	04063	OFF QTR TRANS	7670	1941
72411	04069	OFF QTR TRANS	7670	1941
72411	04070	OFF QTR TRANS	7670	1941
72411	04071	OFF QTR TRANS	7670	1941
72411	04073	OFF QTR TRANS	7670	1941
72411	04074	OFF QTR TRANS	7670	1941
72411	06635	OFF QTR TRANS	7670	1941
72411	06636	OFF QTR TRANS	7670	1941
72411	06639	OFF QTR TRANS	7670	1941
72411	06640	OFF QTR TRANS	7670	1941
73018	00212	REL EDUC FAC	3106	1941
73018	00217	REL EDUC FAC	4720	1941
73018	00219	REL EDUC FAC	4720	1941
73018	02337	REL EDUC FAC	1200	1973
73019	02336	UNIT CHAPEL	3765	1941
72210	06646	UNIT CHAPEL	3765	1941
74015	04065	CIV CLUB FAC	6884	1941
74069	00662	RECREATION BLDG	3663	1943
74069	00680	RECREATION BLDG	1144	1941
74069	00723	RECREATION BLDG	1144	1941
74069	00725	RECREATION BLDG	1144	1941
74069	00730	RECREATION BLDG	1250	1942
74069	02712	RECREATION BLDG	1144	1941
74069	02716	RECREATION BLDG	1144	1941
74069	02834	RECREATION BLDG	1144	1941
74069	02835	RECREATION BLDG	1144	1941
74069	02845	RECREATION BLDG	1144	1941
74069	02856	RECREATION BLDG	1144	1941

TABLE 2.1.3.3 BUILDINGS THAT NO LONGER EXIST  
NO ECOs EVALUATED

CATEGORY	BLDG	CATEGORY_DESCR	AREA (SQ FT)	YEAR
74069	02907	RECREATION BLDG	1144	1941
74069	06643	RECREATION BLDG	2892	1941
74069	06649	RECREATION BLDG	18899	1941

TABLE 2.1.3.4 - BUILDINGS THAT ARE NOT LOCATED AT FORT KNOX  
NO ECOS EVALUATED

CATEGORY	BLDG	CATEGORY/DESCRIPTION	AREA (SQ FT)	YEAR
17130	K0105	APPL INST BLDG	3217	1959
17140	SP002	ARMY RES CENTER	3140	1959
17140	B0001	ARMY RES CENTER	33900	1950
17140	B0003	ARMY RES CENTER	52398	1980
17140	B0100	ARMY RES CENTER	31689	1970
17140	BL002	ARMY RES CENTER	11734	1961
17140	BR001	ARMY RES CENTER	4396	1958
17140	C0300	ARMY RES CENTER	39869	1965
17140	C4076	ARMY RES CENTER	28950	1962
17140	CI003	ARMY RES CENTER	12483	1959
17140	CL002	ARMY RES CENTER	23700	1960
17140	CM002	ARMY RES CENTER	30403	1958
17140	CS001	ARMY RES CENTER	23930	1963
17140	D0001	ARMY RES CENTER	14343	1961
17140	D1026	ARMY RES CENTER	12124	1959
17140	DA001	ARMY RES CENTER	15100	1975
17140	DL002	ARMY RES CENTER	13255	1960
17140	FL004	ARMY RES CENTER	28974	1962
17140	FR002	ARMY RES CENTER	4396	1961
17140	H1052	ARMY RES CENTER	22634	1956
17140	JM001	ARMY RES CENTER	6919	1980
17140	KN002	ARMY RES CENTER	4396	1961
17140	L0001	ARMY RES CENTER	40509	1957
17140	LA003	ARMY RES CENTER	42328	1980
17140	M2002	ARMY RES CENTER	13350	1970
17140	MA002	ARMY RES CENTER	4396	1961
17140	ML002	ARMY RES CENTER	13000	1981
17140	MN001	ARMY RES CENTER	11759	1958
17140	O2052	ARMY RES CENTER	4396	1960
17140	PM003	ARMY RES CENTER	11947	1960
17140	S1006	ARMY RES CENTER	25039	1956
17140	TD001	ARMY RES CENTER	23623	1962
17140	TR002	ARMY RES CENTER	4476	1962
17140	W0001	ARMY RES CENTER	11800	1961
17140	W4051	ARMY RES CENTER	20799	1962
17140	X2001	ARMY RES CENTER	29212	1958
17140	Y2076	ARMY RES CENTER	23652	1951
17140	Z0001	ARMY RES CENTER	13955	1970
21410	B0002	VEH MNT SH ORG	3892	1962
21410	B0101	VEH MNT SH ORG	6298	1970
21410	BL003	VEH MNT SH ORG	2519	1961
21410	BR012	VEH MNT SH ORG	1325	1958
21410	C0077	VEH MNT SH ORG	8882	1919
21410	C0301	VEH MNT SH ORG	7498	1965
21410	C4077	VEH MNT SH ORG	6256	1962
21410	CI004	VEH MNT SH ORG	3690	1959
21410	CL003	VEH MNT SH ORG	3700	1960
21410	CM003	VEH MNT SH ORG	6009	1958

TABLE 2.1.3.4 - BUILDINGS THAT ARE NOT LOCATED AT FORT KNOX  
NO ECOs EVALUATED

CATEGORY	BLDG	CATEGORY/DESCRIPTION	AREA (SQ FT)	YEAR
21410	CS002	VEH MNT SH ORG	3800	1963
21410	D0002	VEH MNT SH ORG	2587	1972
21410	D1027	VEH MNT SH ORG	3065	1960
21410	DA002	VEH MNT SH ORG	2937	1975
21410	DL003	VEH MNT SH ORG	5529	1960
21410	FL005	VEH MNT SH ORG	12964	1962
21410	FR003	VEH MNT SH ORG	1325	1961
21410	FT187	VEH MNT SH ORG	3865	1975
21410	H1053	VEH MNT SH ORG	3716	1960
21410	KN003	VEH MNT SH ORG	1325	1959
21410	L0002	VEH MNT SH ORG	6092	1957
21410	LM002	VEH MNT SH ORG	2656	1977
21410	M2003	VEH MNT SH ORG	0	1979
21410	MA003	VEH MNT SH ORG	1325	1961
21410	ML003	VEH MNT SH ORG	4300	1981
21410	MN011	VEH MNT SH ORG	2656	1959
21410	O2053	VEH MNT SH ORG	1325	1960
21410	PM004	VEH MNT SH ORG	2640	1960
21410	RS011	VEH MNT SH ORG	14440	1946
21410	S1007	VEH MNT SH ORG	6097	1956
21410	SP003	VEH MNT SH ORG	2656	1959
21410	TD002	VEH MNT SH ORG	3997	1962
21410	TR003	VEH MNT SH ORG	1325	1962
21410	W0002	VEH MNT SH ORG	2640	1960
21410	W4052	VEH MNT SH ORG	14400	1946
21410	X2002	VEH MNT SH ORG	6097	1956
21410	Y2077	VEH MNT SH ORG	6656	1951
21420	C0107	VEH MNT SH ORG	1312	1898
21420	LA004	VEH MNT SH ORG	4951	1980
21470	FL003	OIL STO BLDG	127	1962
21910	C0076	FE MAINT SHOP	2910	1892
21910	C0104	FE MAINT SHOP	840	1910
21910	C0105	FE MAINT SHOP	1500	1894
72140	P0904	CV DORMITORY	1600	1942
72321	P0900	DET LATRINE BDG	685	1942
72321	P1256	DET LATRINE BDG	564	1942
72321	P1266	DET LATRINE BDG	564	1942
72321	P1267	DET LATRINE BDG	864	1942
72321	P1268	DET LATRINE BDG	864	1942
72321	P1269	DET LATRINE BDG	864	1942
72321	P1389	DET LATRINE BDG	864	1942
72321	P1391	DET LATRINE BDG	864	1942
72321	P1423	DET LATRINE BDG	864	1942
72321	P1488	DET LATRINE BDG	864	1942
72321	P1499	DET LATRINE BDG	864	1942
72321	P1614	DET LATRINE BDG	864	1942
72321	P1712	DET LATRINE BDG	864	1942
73017	P1003	POST CHAPEL	3826	1942

TABLE 2.1.3.4 - BUILDINGS THAT ARE NOT LOCATED AT FORT KNOX  
NO ECOs EVALUATED

CATEGORY	BLDG	CATEGORY/DESCRIPTION	AREA (SQ FT)	YEAR
74046	P1738	OPEN DIN CONS	36515	1942
74050	C0103	EXCHANGE BRANCH	8135	1896
74069	P0910	RECREATION BLDG	4720	1942
74069	P0911	RECREATION BLDG	4720	1942
74069	P1021	RECREATION BLDG	4720	1942
74069	P1022	RECREATION BLDG	4720	1942
74069	P1023	RECREATION BLDG	4720	1942
74069	P1024	RECREATION BLDG	4720	1942

TABLE 2.1.3.5 - NON-APPROPRIATED FUND FACILITIES  
NO ECOs EVALUATED

CATEGORY	BLDG	CATEGORY/DESCRIPTION	AREA (SQ FT)	YEAR
74050	00103	EXCHANGE BRANCH	8135	1896
74050	00708	EXCHANGE BRANCH	4736	1987
74050	01490	EXCHANGE BRANCH	3929	1957
74050	02013	EXCHANGE BRANCH	12188	1988
74050	02318	EXCHANGE BRANCH	7180	1938
74050	04770	EXCHANGE BRANCH	4810	1958
74050	04991	EXCHANGE BRANCH	2580	1960
74050	05929	EXCHANGE BRANCH	4783	1969
74050	06585	EXCHANGE BRANCH	8440	1957
74050	06703	EXCHANGE BRANCH	6683	1941
74050	07037	EXCHANGE BRANCH	3854	1941
74051	00126	EXCHANGE CAFE	16200	1974
74052	01395	EXCH SVC STA	5573	1954
74052	01611	EXCH SVC STA	600	1975
74052	04990	EXCH SVC STA	2184	1960
74053	00127	EXCH MAIN RETL	83940	1974
74055	00051	EXCH WAREHOUSE	10110	1954
74055	00052	EXCH WAREHOUSE	9030	1954
74055	02198	EXCH WAREHOUSE	1440	1940
74056	00263	EXCH SVC OUTLET	2430	1941
74056	01328	EXCH SVC OUTLET	13102	1930
74056	02012	EXCH SVC OUTLET	3317	1987
74056	02320	EXCH SVC OUTLET	7180	1938
74056	02830	EXCH SVC OUTLET	1450	1942
74056	07040	EXCH SVC OUTLET	1296	1941

## 2 METHODS AND APPROACH

### FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY

#### 2.2 CALCULATIONS

Energy calculations were performed using computerized techniques. Due to the large volume of calculations to be performed, standardized spreadsheets and procedures were developed. This assured consistent results and uniformity of quality in all of the calculations performed.

##### 2.2.1 Baseline Water and Energy Consumption

The annual potable water production for Fort Knox from July 1993 through June 1994 was 1,421,100,000 gallons. The volume of sewage treated was 1,055,500,000. The net volumetric difference between potable water produced and sewage treated is 365,600,000 gallons more of potable water produced. Factors that affect the net differences are irrigation, evaporation, and storm water infiltration. The annual rainfall corresponding to the same period came to 50 inches. It is quite possible that the metering methods are not accurate.

The following sections will describe the method for calculating the baseline energy consumption for each of the ECOs.

##### 2.2.1.1 Baseline Water and Energy Consumption

The baseline water and energy consumption for each ECO was calculated using a LOTUS123 spreadsheet. The water consumption was modeled using industry standards, field measurements and population data at Fort Knox. The information necessary to calculate the baseline include the following:

1. Category Codes
2. Square Footage and Age
3. Occupancy Schedule
4. Plumbing Fixture Count
5. Water Flow Measurements
6. Fuel Sources

The above information was obtained during the field survey.

##### 2.2.2 ECO Water and Energy Consumption

The following sections describe how the water and energy savings for each ECO was calculated.

## 2 METHODS AND APPROACH

### FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY

#### 2.2.2.1 ECO Water and Energy Consumption: ECO-1 Spring Loaded Faucets

The water and energy savings are calculated using the differential between the measured existing flow rate and the new flow rate. The new flow rate is based upon manufacturer data. American Society of Heating, Refrigerating and Air-conditioning Engineers and American Society of Plumbing Engineer standards were used to estimate frequency of demand.

#### 2.2.2.2 ECO Water and Energy Consumption: ECO-2 Faucet Aerators

The water and energy savings are calculated using the differential between the measured existing flow rate and the new flow rate. The new flow rate was obtained from manufacturer data. The new flowrate is 50% of the existing measured flowrate. American Society of Heating, Refrigerating and Air-conditioning Engineers standards were used to calculate daily consumption. Building occupancy data was used in the calculations.

#### 2.2.2.3 ECO Water and Energy Consumption: ECO-2FH Faucet Aerators (Family Housing)

The water and energy savings are calculated using the differential between the measured existing flow rate and the new flow rate. The new flow rate was obtained from manufacturer data; the new flowrate is 50% of the existing measured flow rate. American Society of Heating, Refrigerating and Air-conditioning Engineers standards were used to calculate daily consumption. Family housing population data was used in the calculations.

#### 2.2.2.4 ECO Water and Energy Consumption: ECO-3 Flush Valve Retrofits for Water Closets

The water and savings are calculated using the differential between the existing flow rate and the new flow rate. The existing flush valve flow rate of 4.5 gallons per flush, or 17 liters per flush, was determined in the field. The new flush valve flow rate of 3.5 gallons per flush, or 13.2 liters per flush, is based upon manufacturer performance data. American Society of Plumbing Engineers standards were used to estimate frequency of demand and daily consumption. Building occupancy data was used in the calculations.

## 2 METHODS AND APPROACH

### FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY

#### 2.2.2.5 ECO Water Consumption: ECO-3FH Water Closet Replacements (Family Housing)

The water and savings are calculated using the differential between the existing flow rate and the new flow rate. The existing flow rate was determined in the field to be 5 gallons per flush, or 19 liters per flush. The new flow rate was based upon manufacturer data of 1.6 gallons per flush, or 6 liters per flush. American Society of Plumbing Engineers standards were used to estimate frequency of demand. Family housing population data was used in the calculations. Five flushes per day, per occupant, were used.

#### 2.2.2.6 ECO Water Consumption: ECO-4 Flush Valve Retrofits for Urinals

The water and savings are calculated using the differential between the existing flow rate and the new flow rate. The existing flow rate of 1.5 gallons per flush, or 5.7 liters per flush, was measured in the field. The new flow rate of 1.0 gallons per flush, or 3.8 liters per flush, is based upon manufacturer performance data. American Society of Plumbing Engineers standards were used to estimate frequency of demand. Building occupancy data was used in the calculations.

#### 2.2.2.7 ECO Water and Energy Consumption: ECO-6 Dining Facilities (Kitchen) Retrofits

The water and energy savings are calculated using the differential between the measured existing flow rate and the new flow rate. The retrofit evaluated consisted of installing aerators on the kitchen sinks that were not used for pot filling. The aerators were assumed to decrease the flow rate by 50% per manufacturer data. American Society of Heating, Refrigerating and Air-conditioning Engineers standards were used to estimate frequency of demand.

#### 2.2.2.8 ECO Water and Energy Consumption: ECO-7 Golf Course Irrigation

The potable water meter readings were used to determine the annual consumption. The cost to switch to a raw water well supply was calculated using calculated pump run times and brake horsepower. The calculations were based upon a well depth of 200 feet and a casing size of six inches. The estimated well pump horse power is 75 horsepower per well.

#### 2.2.2.9 ECO Water and Energy Consumption: ECO-8 Post Laundry Retrofits

The steam loss from failed steam traps was calculated using Napier's equation and boiler plant operating logs.

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### FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY

#### 2.2.2.10 ECO Water and Energy Consumption: ECO-9 Water Treatment Plant's and Well Field's Motors and Pumps

The existing water pump and motor efficiencies were evaluated. The water pumps were found to be very efficient. However, the pump motors were not high efficiency motors. The electrical savings were calculated for replacing the existing motors with high efficiency motors.

#### 2.2.2.11 ECO Water and Energy Consumption: ECO-10 Manhole Sump Pump Repairs (Heating) Life Cycle Cost Analyses

The energy savings were determined by calculating the differential piping heat loss between piping in a flooded manhole and a dry manhole.

#### 2.2.2.12 ECO Water and Energy Consumption: ECO-11 Sensor Controls for Faucets

The water and energy savings are calculated using the differential between the measured existing flow rate and the new flow rate. American Society of Heating, Refrigerating and Air-conditioning Engineers standards were used to estimate frequency of demand.

#### 2.2.2.13 ECO Water and Energy Consumption: ECO-12 Water Heater Insulation Blankets (Family Housing)

The energy savings were determined by calculating the differential in heat loss between the water heater with, and without, the insulating blanket.

#### 2.2.2.14 ECO Water Consumption: ECO-16 Cooling Tower Water Treatment

The water savings were calculated using the differential in blowdown rate between the existing chemical water treatment system and a new ozone water treatment system. The existing blowdown rate was determined in the field and is based upon 3 cycles of concentration. The cycles of concentration for the new ozone treatment system is calculated to be 6 cycles. The savings is the differential in the annual water blowdown losses and the cost of chemicals.

### 2.3 ECOS REJECTED AFTER ANALYSIS

ECOs 9, 11, 12, and 16 were rejected due to insufficient savings after calculations were completed.

## 2 METHODS AND APPROACH

### FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY

#### 2.3.1 ECO-9 Water Treatment Plants and Wellfield Motors and Pumps

The water treatment plant and well field motors were evaluated as ECO-9. Savings are based on the installation of high efficiency motors. The energy savings that result are not great enough to justify replacement of all motors at this time. It is recommended to install higher efficiency motors when the existing motors need to be replaced.

The LCCID report calculation sheet and cost estimate for ECO-9 are in Appendix D.

#### 2.3.2 ECO-11 Sensor Controls for Faucets

Sensor controls for faucets, urinals and toilets were evaluated for two barracks. It is evident that the savings do not justify the cost to install these systems. Other ECOs have higher SIR and lower payback periods so sensors were not evaluated for all buildings.

The water savings is assumed to be equal to that calculated for ECO-1, ECO-3, and ECO-4. The LCCID reports and cost estimates are in Appendix D.

#### 2.3.3 ECO-12 Water Heater Insulation Blankets

The addition of an insulation blanket on hot water heaters in family housing units does not result in significant energy savings. Most water heaters are well insulated and additional insulation does not reduce heat loss significantly. This ECO was evaluated for two family housing units. It is evident that the payback period and SIR are very poor, therefore no other buildings were evaluated for this ECO.

The LCCID reports, calculation sheets, and cost estimates for this ECO are in Appendix D.

#### 2.3.4 ECO-16 Cooling Tower Water Treatment

The water and chemical savings calculated for switching from chemical water treatment to ozone water treatment were insufficient to achieve a payback of less than ten years. The cooling tower operates only six months a year. If the tower operated year round, the project may have had payback of less than ten years.

The calculation sheets for this ECO are in Appendix D.

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### FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY

#### 2.4 COST ESTIMATES

The cost estimates for the ECOs were obtained using a variety of sources. This section explains how each part of the cost estimate was determined.

The initial cost for each ECO is the sum of the construction costs for the project and the project costs. The construction costs include all costs in materials, labor, and contractor's overhead and profit. The project costs include supervision, inspection, and overhead (SIOH) for the project and the project design costs.

##### 2.4.1 Construction Costs

The construction costs for each ECO were estimated using MeansData for Windows Spreadsheets, Version 2.0a, cost estimating software. Prices not available in the accompanying database were obtained using a combination of sources. These sources include the following:

- Local suppliers and vendors
- Systems Corp Estimating Data

All pricing has been adjusted, where applicable, to represent the labor costs in the Fort Knox labor market. The construction cost estimates have been prepared to include a reasonable level of detail for each ECO calculated. The construction costs include an additional contingency and 10% profit. A minimum contingency of 10% was used, higher contingencies were used on some projects.

##### 2.4.2 Project Costs

The project costs for each ECO include the cost of supervision, inspection, and overhead required to complete the project. A value of 5.0% of the construction cost has been used for the SIOH. Also included in the project costs is the cost to design each ECO. The design cost has been included at a fixed value of 5.0% of construction cost. This approach assures consistent values have been used for the project costs, allowing for combination of ECOs into larger projects without the need to adjust these values.

#### 2.5 ECO LIFE CYCLE COSTS

The life cycle cost analyses for the ECOs are a combination of energy costs, investment costs, maintenance costs, and replacement costs. Each of these components may, or may not, be significant

## 2 METHODS AND APPROACH

### FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY

factors in determining the life cycle cost of the project. Each of these cost components has been evaluated for each ECO to determine the contribution, if any, to the life cycle cost of the project.

The life cycle costs were calculated using the computer program Life Cycle Costing in Design (LCCID) as required in the Scope of Work.

#### 2.5.1 Energy and Water Costs

Energy costs for each type of fuel used in the facilities included in this project were obtained from the installation and through the Defense Energy Information System (DEIS). The costs were obtained along with the amount of energy used for FY93. Average annual water, sewage and energy costs per unit were calculated. Electricity, fuel oil and natural gas are the only sources of energy related to the study.

Cost/MBtu	
Electric	= \$0.02505/KWH or \$25.05/MWH
Fuel Oil	= \$5.05/MBtu or \$17.15/MWH
Natural Gas	= \$3.10/MBtu or \$10.51/MWH
Cost/Kgal	
Water	= \$0.9409/KGAL or \$0.249/Kliter
Sewage	= \$0.6292KGAL or \$0.160/Kliter

#### 2.5.2 Maintenance and Replacement Costs

The maintenance and operating costs/savings for each ECO were calculated, where applicable. First considered was whether the annual recurring (maintenance and operation) non-energy costs would significantly change as a result of each ECO. These values are sometimes unjustifiably manipulated to produce the desired results for the project economic analysis. Therefore, it was typically assumed maintenance and operation activities will continue at the same rate as before the project. However,

## 2      METHODS AND APPROACH

### FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY

readily identifiable differences, such as boiler maintenance, have been included. The estimated costs were obtained from the Means Facilities Maintenance and Repair Costs Data, 1994. These costs are shown on each corresponding life cycle summary sheet included in this report.

The replacement costs (non-energy non-annual recurring cost) for each ECO will be evaluated in the same manner as non-energy annual recurring cost. An example of this type of cost item is the replacement of the cartridge in spring-loaded faucets.

It is the policy of Systems Corp to be conservative when estimating these more subjective cost components--which, if improperly evaluated, could result in inappropriate project qualification and funding decisions.

### 3 *ECIP PROJECT 1*

*FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY*

This section contains the project description and the DD1391 forms for ECIP Project FH-1, Family Housing Water Conservation Phase I improvements to 328 Family Housing Units. Two lists of the buildings included in the project follow the DD1391 forms. The first list includes all buildings considered in the project in numerical order. The second list shows which buildings were used to model unsurveyed buildings. Following these lists are the LCCID report and the cost estimate for the proposed project. Calculation sheets for the individual buildings follow the project cost estimate. Below is a detailed index of the information included in this section.

DD1391 Form . . . . .	3-2
Table 3.1 ECIP FH-1 - Family Housing . . . . .	3-6
Table 3.2 Buildings Modeled by Surveyed Buildings . . . . .	3-9
Project LCCID Report . . . . .	3-11
Cut Sheets/Product Information . . . . .	3-12
Project Cost Estimate . . . . .	3-13
Building Calculation Sheets . . . . .	3-16

DATE: 22 December 1994  
PROJECT NO.: ECIP-FH1  
PROJECT TITLE: Family Housing Water Conservation Phase I  
INSTALLATION: Fort Knox  
LOCATION: Kentucky

PRIMARY FACILITY

Water Closets and Faucet Aerators \$887,000

ESTIMATED CONTRACT COST	\$733,636
CONTINGENCY PERCENT (10%)	73,364
SUBTOTAL	807,000
SUPERVISION, INSPECTION & OVERHEAD (5%)	40,350
DESIGN COST	40,350
TOTAL REQUEST	887,700
TOTAL REQUEST (ROUNDED)	\$888,000

Replace water closets in 1354 family housing units with water saving, 6 liters (1.6 gallons) per flush water closets, and install faucet aerators in 328 family housing units. All water closets will be of the flush tank type. The project will significantly reduce potable water consumption and sanitary waste production.

DATE: 22 December 1994  
PROJECT NO.: ECIP-FH1  
PROJECT TITLE: Family Housing Water Conservation Phase I  
INSTALLATION: Fort Knox  
LOCATION: Kentucky

PROJECT:

Replace water closets in 1354 family housing units with water saving, 6 liters (1.6 gallons) per flush water closets, and install faucet aerators in 328 family housing units.

REQUIREMENTS:

Fort Knox utilizes inefficient outdated water closets in its family housing units. The existing water closets consume significantly more water and generate greater quantities of sanitary waste per flush than the new standard water saving water closet. The existing inefficient systems place greater demand on the water table, water treatment plant and waste treatment plant. The U.S. Army Corp of Engineers, Louisville District, contracted an Energy Engineering Analysis Program (EEAP) Water Conservation Study of the Post. The study identified energy and water conservation opportunities. Life cycle cost analysis was performed on each opportunity to determine its discounted savings-to - investment ratio (SIR) and estimated payback period. This project has a SIR of 2.61 and a simple payback period of 5.73 years. The project exceeds the minimum requirements of an SIR greater than 1.25 and a simple payback of less than 10 years.

CURRENT SITUATION:

The family housing units at Ft. Knox have inefficient water closets and lack aerators at many sinks. The family housing units consume more water and generate more sanitary waste than is necessary. The new water closets and aerators will greatly reduce the water consumption and waste generated.

IMPACT IF NOT PROVIDED:

If this project is not implemented, 1354 family housing units will continue to consume more water and generate more waste than necessary. The U.S. Army will fail to realize an estimated \$155K in annual savings (FY95\$) and a total discounted savings of \$2.32M during the twenty year life of the project.

ADDITIONAL:

A life cycle cost analysis was performed on the project. The project will realize water savings of over 2.6 times the initial investment cost and will pay for itself in less than 5.8 years.

Ft. Knox is not on the list of installations considered for closure or realignment.

DATE: 22 December 1994  
PROJECT NO.: ECIP-FH1  
PROJECT TITLE: Family Housing Water Conservation Phase I  
INSTALLATION: Fort Knox  
LOCATION: Kentucky

#### SECTION 11 - ECONOMIC ANALYSIS DATA

##### 11D ECONOMIC JUSTIFICATION SUMMARY

This water conservation project is recommended for funding. A life cycle cost analysis was performed on each portion of this project and on the overall project. The overall project will realize water savings of over 2.6 times the initial investment cost and will pay for itself in less than 5.8 years.

TABLE 3.1 ECIP FH-1 - FAMILY HOUSING

414 B	443 A	1201	1436 A
414 A	447	1202	1436 B
415 A	448	1203	1438 B
415 B	449 B	1204	1438 A
416 A	449 A	1401	1439 A
416 B	450	1402	1439 B
417 A	451 A	1403	1440 A
417 B	451 B	1404	1440 B
418 A	452 A	1405	1441 B
418 B	452 B	1406	1441 A
419	453 B	1408	1442 A
419 B	453 A	1409	1442 B
420 B	454 A	1410	1443 B
420 A	454 B	1411 A	1443 A
421 B	455 A	1411 B	1444 A
421 A	455 B	1412	1444 B
422 A	456 B	1413 A	1444 A
422 B	456 A	1413 B	1445 B
423	457 B	1416 A	1446 B
424	457 A	1416 B	1446 A
425	458 B	1417	1447
426	458 A	1418 A	1453 B
427	459 A	1419 B	1453 A
431 A	459 B	1419 A	1454 B
431 B	460 B	1420 A	1454 A
432 A	460 A	1420 B	1455 B
432 B	461 A	1422 A	1455 A
434 B	461 B	1422 B	1457 A
434 A	462 B	1423	1457 B
435 A	462 A	1424 B	1458 B
435 B	1004	1424 A	1458 B
436 A	1120	1426	1458 A
436 B	1122	1427	1458 A
437 A	1125 A	1429 B	1459 B
437 B	1125 B	1429 A	1459 A
438 B	1126 A	1430 A	1460 A
438 A	1126 B	1430 B	1460 B
439 A	1127 A	1431 B	1461 A
439 B	1128 A	1431 A	1461 B
440 B	1128 B	1432	1462 A
440 A	1132	1432 B	1462 B
441 A	1133	1433 B	1463 A
441 B	1134	1433 A	1463 B
442 A	1135	1434 A	1464 B
442 B	1136	1434 B	1464 A
443 B	1200	1435 A	1465 A

1465 B	4257	4332 B	7511 A
1466 B	4258	4332 A	7511 B
1466 A	4259	4333 A	7512 A
4016	4260	4333 B	7512 B
4026	4261	4334 A	7513 A
4026	4262	4334 B	7513 B
4027	4263	4335 B	7514 A
4029	4264	4335 A	7514 B
4030	4265	4336 B	7515 A
4031	4266	4336 A	7515 B
4032	4267	4338 B	7516 B
4033	4268	4338 A	7516 A
4034	4269	4339 B	7518 B
4035	4270	4339 A	7518 A
4036	4271	4340 B	7518 B
4037	4272	4341 B	7519 A
4038	4273	4341 B	7519 B
4039	4274	4341 A	7520 A-H
4040	4276	4342 A	7521 B
4041	4277	4342 B	7521 A
4043	4278	4343 A	7522 B
4044	4279	4343 B	7522 A
4045	4280	4349	7523 B
4046	4281	4351	7523 A
4047	4282	4354	7523 B
4048	4283	4356	7524 A-H
4049	4284	4357	7525 A
4086	4285	4358	7526 B
4087	4286	4359	7526 A
4088	4287	4360	7527 B
4089	4288	4361	7527 A
4090	4301 A	4362 A	7528 A
4091	4301 B	4362 B	7528 B
4092	4303 A	4363 B	7529 A
4093	4303 B	4363 A	7529 B
4094	4305 A	4363	7530 A
4095	4305 B	4364 B	7530 B
4096	4306 A	4364 A	7531 A
4098	4306 B	4365 A	7531 B
4099	4307 B	4365 B	7532 A
4100	4307 A	4367	7532 B
4102	4308 A	4369	7533 A
4103	4308 B	5054	7533 B
4105	4310 A	5314	7534 B
4106	4330 B	7480 A-H	7534 A
4107	4330 A	7493 A-H	7535 A
4113	4331 B	7510 A	7535 B
4114	4331 A	7510 B	7536 A

7536 B	7556 B	7874 B	9045 A-D
7537 B	7557 A	7874 A	9046 A-H
7537 A	7557 B	7876 B	9047 A-H
7538 A	7558 A	7876A	9048 A, C-H
7538 B	7558 B	7878A	9049 A-H
7539 A	7559 A	7878B	9052 A-H
7539 B	7559 B	7801 B - 7820 B	9053
7540 B	7740 A-H	7801 A - 7868 A	9053 A, C-H
7540 A	7744 A-G	7822 B - 7833 B	9054 A-G
7541 A	7745 A-H	7835 B - 7860 B	9055 A-H
7541 B	7746 A-D	7862 B - 7872 B	9056 A-D
7542 B	7747 B-G	7870 A - 7872 A	9057 A-H
7542 A	7747 A-H	7880 B - 7888 B	9058 A-H
7543 A	7748 A-G	7880 A - 7888 A	9060 A-D
7543 B	7749 A-H	7980 A-H	9109 A-H - 9111 A-H
7544 A	7749 B-G	7982 A-D	9110 A-H
7544 B	7750 D	7983 A-D	9112 A-D
7545 A	7750 B-C	7984 A-H	9113 A-H
7545 B	7750	7985 A-H	9114 A-D
7546 A	7751 B	7987 A-D	9115 A-H
7546 B	7751 A-D	7989 A-H	9115 A-H
7547 A	7751	7991 A-H	9116 A-D
7547 B	7753 A-G	9019	9117 A-H
7548 A	7754 A-G	9025 A-G	9118 A-D
7548 B	7755 A-H	9026 A-H	9119 A-H
7549	7756 A-H	9028 A-H	9120 A - 9140 A
7550 A	7757 A-D	9030 A-H	9120 B
7550 B	7758 A-H	9031 A-D	9122 B - 9140 B
7551 A	7759 A-D	9032 A-H	9141
7551 B	7760 A-H	9032 A-H	9142 A - 9163 A
7552 A	7761 B-C	9036 A-H	9142 B - 9163 B
7552 B	7761 A-D	9036 A-H	9206
7553 A	7762 A-D	9037 A-D	9211
7553 B	7762 B-C	9038 A-H	9222
7554 A	7770 A-D	9039 A-H	11127 B
7554 B	7770 B-C	9040 A-C	13435 B
7555 A	7772 A-H	9041 A-H	43460 A
7555 B	7821	9042 A-H	
7556 A	7869	9044 A-H	

TABLE 3.2 BUILDINGS MODELED BY SURVEYED BUILDINGS

BUILDINGS SURVEYED AND CALCULATED	BUILDINGS ASSUMED TYPICAL OF SURVEYED BUILDINGS
1426A	1122, 1132, 1133, 1134, 1135, 1136, 1125A, 1126A, 1127A, 1128A, 1401, 1402, 1411A, 1413A, 1416A, 1419A, 1420A, 1422A, 1424A, 1429A
1426B	1125B, 1126B, 1127B, 1128B, 1403, 1404, 1405, 1406, 1408, 1409, 1410, 1411B, 1412, 1413B, 1416B, 1417, 1419B, 1420B, 1422B, 1423, 1424B, 1427, 1429B, 1447
1432A	1120, 1200, 1201, 1202, 1203, 1204, 1430A & B, 1431A & B, 1432B, 1433A & B, 1434A & B, 1435A & B, 1436 A & B, 1438A & B, 1439A & B, 1440A & B, 1441A & B, 1442A & B, 1443A & B, 1444A & B, 1445A & B, 1446A & B, 1453A & B, 1454A & B, 1455A & B, 1456A & B, 1457A & B, 1458A & B, 1459A & B, 1460A & B, 1461A & B, 1462A & B, 14563A & B, 1464A & B, 1465A & B, 1466A & B, 9206, 9222
4358	4044, 4045, 4046, 4047, 4048, 4049, 4086, 4087, 4088, 4089, 4090, 4091, 4092, 4093, 4094, 4095, 4113, 4114, 415, 4116, 4117, 4118, 4119, 4121, 4326, 4328, 4337, 4349, 4351, 4354, 4356, 4357, 4359, 4360, 4361, 4367, 4369, 5054
4041	4027, 4028, 4032, 4035, 4037, 4100, 4103, 4106, 4107
4096	4026, 4029, 4030, 4031, 4033, 4034, 4036, 4038, 4039, 4040, 4043, 4098, 4099, 4102, 4105
4270	4257, 4258, 4259, 4260, 4261, 4262, 4263, 4264, 4265, 4266, 4267, 4268, 4269, 4271, 4272, 4273, 4274, 4276, 4277, 4278, 4279, 4280, 4281, 482, 4283, 4284, 4285, 4286, 4287, 4288
1363	4301A & B, 4303A & B, 4305A & B, 4306A & B, 4307A & B, 4308A & B, 4310A & B, 4330A & B, 4331A & B, 4332A & B, 4333A & B, 4334A & B, 4335A & B, 4336A & B, 4338A & B, 4339A & B, 4340A & B, 4341A & B, 4342A & B, 4343A & B, 4362A & B, 4363A & B, 4364A & B, 4365A & B,
419	414A, 415A, 416A, 417A, 418A, 420A, 421A, 422A, 431A, 432A, 434A, 435A, 436A, 437A, 438A, 439A, 440A, 441A, 442A, 443A
450A	423, 424, 425, 426, 427, 447, 448, 449A, 451A, 452A, 453A, 454A, 455A, 456A, 457A, 458A, 459A, 460A, 461A, 462A, 1004
450B	414B, 415B, 416B, 417B, 418B, 419B, 420B, 421B, 422B, 431B, 432B, 434B, 435B, 436B, 437B, 438B, 439B, 440B, 441B, 442B, 443B, 449B, 451B, 452B, 453B, 454B, 455B, 456B, 457B, 458B, 459B, 460B, 461B, 462B, 4016

7549A	7510A, 7511A, 7512A, 7513A, 7514A, 7515A, 7516A, 7518A, 7519A, 7520A-H, 7521A, 7522A, 7523A, 7524A-H, 7525A, 7526A, 7527A, 7528A, 7529A, 7530A, 7531A, 7532A, 7533A, 7534A, 7535A, 7536A, 7537A, 7538A, 7539A, 7540A, 7541A, 7542A, 7543A, 7544A, 7545A, 7546A, 7547A, 7548A, 7550A, 7551A, 7552A, 7553A, 7554A, 7555A, 7556A, 7557A, 7558A, 7559A
7549B	7510B, 7511B, 7512B, 7513B, 7514B, 7515B, 7516B, 7518B, 7519B, 7521B, 7522B, 7523B, 7525B, 7526B, 7527B, 7528B, 7529B, 7530B, 7531B, 7532B, 7533B, 7534B, 7535B, 7536B, 7537B, 7538B, 7539B, 7540B, 7541B, 7542B, 7543B, 7544B, 7545B, 7546B, 7547B, 7548B, 7550B, 7551B, 7552B, 7552B, 7554B, 7555B, 7556B, 7557B, 7558B, 7559B
7750	7744A-G, 7746A-D, 7747A & H, 7749A & H, 7750D, 7751A & D, 7757A-D, 7759A-D, 7761A & D, 7762A & D, 7770A & D, 7982A-D, 7983A-D, 7987A-D,
7751	7480A-H - 7493A-H, 7740A-H, 7745A-H, 7747B-G, 7748A-G, 7749B-G, 7750B & C, 7751B, 7753A-G, 7754A-G, 7755A-H, 7756A-H, 7758A-H, 7760A-H, 7761B & C, 7762B & C, 7770B & C, 7772A-H, 7980A-H, 7984A-H, 7985A-H, 7989A-H, 7991A-H, 9019, 9211
5314	9031A-D, 9037A-D, 9040A-C, 9045A-D, 9056A-D, 9060A-D, 9112A-D, 9114A-D, 9116A-D, 9118A-D
5475	9025A-G, 9026A-H - 9030A-H, 9032A-H - 9036A-H, 9038A-H, 9039A-H, 9042A-H - 9044A-H, 9046A-H, 9047A-H, 9049A-H - 9052A-H, 9054A-G, 9055A-H, 9057A-H, 9058A-H, 9109A-H - 9111A-H, 9113A-H, 9115A-H, 9117A-H, 9119A-H
7821	7801B - 7820B, 7822B - 7833B, 7835B - 7860B, 7862B - 7872B, 7874B, 7876B, 7878B, 7880B - 7888B
7869	7801A - 7868A, 7870A - 7872A, 7874A, 7876A, 7878A, 7880A - 7888A
9053	9028A-H, 9032A-H, 9036A-H, 9041A-H, 9048A & C-H, 9053A & C-H, 9110A-H, 9115A-H
9141A	9120A - 9140A, 9142A - 9163A
9141B	9120B, 9122B - 9140B, 9142B - 9163B

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: ECIP-FH1

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID FY95 (92)

INSTALLATION & LOCATION: FT KNOX REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: ECIP-FH1 FAMILY HOUSING PROJECT 1

FISCAL YEAR 1995 DISCRETE PORTION NAME: WATER

ANALYSIS DATE: 12-28-94 ECONOMIC LIFE 20 YEARS PREPARED BY: DERRINGTON

1. INVESTMENT

A. CONSTRUCTION COST	\$	807000.	
B. SIOH	\$	40350.	
C. DESIGN COST	\$	40350.	
D. TOTAL COST (1A+1B+1C)	\$	887700.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)			\$ 887700.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH(1)	SAVINGS MWH/YR(2)	ANNUAL \$ SAVINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS(5)
A. ELECT	\$ 46.40	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 10.51	374.	\$ 3931.	18.58	\$ 73033.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		374.	\$ 3931.		\$ 73033.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 106686.
(1) DISCOUNT FACTOR (TABLE A)	14.88	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 1587488.

B. NON RECURRING SAVINGS(+) / COSTS(-)

ITEM	SAVINGS(+) COST(-) (1)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS(+) COST(-) (4)
1. REPLACEMENT	\$ 887700.	10	.74	656898.
d. TOTAL	\$ 887700.			656898.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-) (3A2+3Bd4) \$ 2244386.

4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE)) \$ 155002.

5. SIMPLE PAYBACK PERIOD (1G/4) 5.73 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 2317419.

7. SAVINGS TO INVESTMENT RATIO (SIR)=(6 / 1G)= 2.61  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

- Water-saving 1.5 gallon flush.
- Features Pressure-Clean™ flushometer tank system.
- Three-bolt quick connect system with factory-installed tank gasket and bolts.

**K-3458** Wellworth Lite PC Toilet, vitreous china, 1.5 gallon flush. Close-coupled design with elongated bowl. Minimum roughing-in is 12" (305 mm). Tank/bowl combination includes K-4333 bowl, K-4470 vitreous china tank with Kohler 81100 flushometer tank system, K-4471 tank cover and K-9434 chrome-plated trip lever.

**IMPORTANT**—For most satisfactory operation, a minimum static water pressure of 25 P.S.I. is required at the toilet supply inlet.

**Recommended Seats and Supply**

**K-4650** Lustra™ solid plastic seat with open front and cover.

**K-4652** Lustra solid plastic seat with closed front and cover.

**K-4670-C** Lustra solid plastic seat (K-4681-C Black Black™) with open front and check hinge.

**K-7637** ¾" angle supply with stop.

**Tank Locks**—Add suffix "-T" to product number.

**Bedpan Lugs**—Add suffix "-L" to product number.

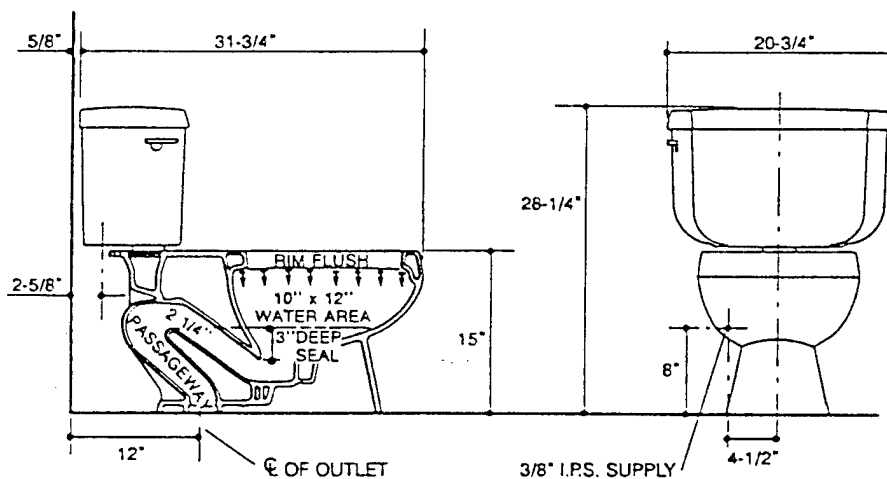
For complete color selection, see Colors section.



**K-3458**

Wellworth Lite PC Toilet and Lustra seat (K-4652) in White.

U.S. Pat. Pending



**KOHLER**

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Estimate:      ECO - 2 & 3      Date:      15-Dec-94
Description:    INSTALL AERATORS & WATER CLOSETS - FAMILY HOUSING
Project:        LIMITED EEAP (WTR) Bid Date:
Location:       FORT KNOX, KY   Job #:      94013.03
Sq. footage:    FAM HSG - GP 1   City indx: Louisville, KY
=====

```

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1511410975	ECO - 3 INSTALL 3.5 GAL FLUSH VALVE REPAIR KIT IN EXISTING WATER CLOSETS					46.00 Ea.	
Unit values		1.24	15.00	35.04	0.00	0.00	50.04
Totals		57.04	\$690	\$1,612	\$0	\$0	\$2,302
1511412805	ECO - 2 INSTALL AERATOR, LAVATORY FAUCET					328.00 Ea.	
Unit values		0.25	1.00	7.08	0.00	0.00	8.08
Totals		82.00	\$328	\$2,321	\$0	\$0	\$2,649
1521801100	ECO - 3 INSTALL NEW WATER SAVING WATER CLOSET, TANK TYPE, FLOOR MNTD, 2PC WHITE W/SEAT, 1.6 GPF					1910.00 Ea.	
Unit values		4.02	235.00	114.30	0.00	0.00	349.30
Totals		7678.20	\$448,850	\$218,318	\$0	\$0	\$667,168
U15 MECHANICAL		7818	\$449,868	\$222,251	\$0	\$0	\$672,119

```
=====
Line #      Description
-----
            Manhours   Matl     Labor   Equipment   Sub     Total
=====
```

ESTIMATE TOTAL	7818	\$449,868	\$222,251	\$0	\$0	\$672,119
SALES TAX	0.00%	\$0				
MATL MARKUP	0.00%	\$0				
LABOR MARKUP	0.00%		\$0			
EQUIPT MARKUP	0.00%			\$0		
SUB MARKUP	0.00%				\$0	
TOTAL BEFORE CONTINGENC		\$449,868	\$222,251	\$0	\$0	\$672,119
CONTINGENCY	10.00%					\$67,212
BOND	0.00%					\$0
PROFIT	10.00%					\$67,212
JOB TOTAL						\$806,543

```

=====
Estimate:      ECO - 2 & 3      Date:      15-Dec-94
Description:    INSTALL AERATORS & WATER CLOSETS - FAMILY HOUSING
Project:        LIMITED EEAP (WTR) Bid Date:
Location:       FORT KNOX, KY   Job #:      94013.03
Sq. footage:    FAM HSG - GP 1   City indx: Louisville, KY
=====

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## SUMMARY

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              Manhours   Matl      Labor   Equipment   Sub      Total
=====
U15 MECHANICAL    7818   $449,868   $222,251           $0          $0   $672,119
TOTAL              7818   $449,868   $222,251           $0          $0   $672,119

SALES TAX          0.00%           $0
MATL MARKUP        0.00%           $0
LABOR MARKUP       0.00%           $0
EQUIPT MARKUP      0.00%           $0
SUB MARKUP         0.00%           $0

TOTAL BEFORE CONTINGENC $449,868   $222,251           $0          $0   $672,119
CONTINGENCY        10.00%           $67,212
BOND               0.00%           $0
PROFIT            10.00%           $67,212

JOB TOTAL                                     $806,543

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# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

100

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO.: **419 A** FUNCTION: UNACCOM PERS HOUS DET FAC  
 Occupancy: FAMILY Operating Hours: 24  
 TYPICAL OF 21 UNITS

ECO Number ECO Type	Existing Fixture System		Retrofited Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
	Description	LPM	Description	LPM			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2	
Lavatory Sinks							
ECO1 TOTAL:							
2	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0
Misc. Sinks	SERVICE SINK	22.7	INSTALL AERATOR	9.5	60	1	
ECO2 TOTAL:							
3	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	14600	1	
Water Closets							
ECO3 TOTAL:							
4		LPF		LPF	#FL/YR	1	0
Urinals							
ECO4 TOTAL:							
5	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	0
Shower Heads							
ECO5 TOTAL:							
6	40 GAL REPUBLIC #406	TEMP		TEMP		1	0
Water							
Heater	CAPACITY: 38,000 BTU/H	325	REDUCE STORAGE TEMP	322	8760	1	
(GAS)	RECOVERY: 32 GAL/HR		INSTALL INSUL JACKET	322	8760	1	
ECO6 TOTAL:						1	0

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 419 A      Water Rate: 0.42 \$/KL      Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH      Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	Total
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving		
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		47,520				0	\$0.20	\$1.34	\$1.34	\$9.70
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		47,520		0	0	0	\$0.20	\$1.34	\$1.34	\$9.70
3	Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$418.80
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$78.16	\$418.80
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	EST ANNUAL									
Water	HOT WTR					0.23		\$2.42	\$2.42	\$16.80
Heater	CONSUMPTION					0.07		\$0.71	\$0.71	\$60.00
(GAS)	(LITERS)									
	43,946									
ECO6 TOTAL:		43,946		0	0	0	\$0.00	\$3.13	\$3.13	\$76.80

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										10
CALCULATION WORK SHEET 1										DATE: 5 OCT 94
FACILITY NO. :		450 A&B		FUNCTION:		UNACCOM PERS HOUS DET FAC				
Occupancy:		FAMILY		Operating Hours:		TYPICAL OF 58 UNITS				
						24				
ECO Number	ECO Type	Existing Fixture System	Description	LPM	Retrofited Fixture System	Description	LPM	Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
1	Lavatory Sinks	SINK W/ AERATOR		9.5	NO RETROFIT		9.5	125	2	
ECO1 TOTAL:										
2	Misc. Sinks	KITCHEN SINK		9.5	NO RETROFIT		9.5	365	1	0
		SERVICE SINK		22.7	INSTALL AERATOR		9.5	60	1	
ECO2 TOTAL:										
3	Water Closets	TANK TYPE		19	1.6 GPF TANK TYPE TOILET		6.1	14600	1	
ECO3 TOTAL:										
4	Urinals			LPF			LPF	#FL/YR	1	0
ECO4 TOTAL:										
5	Shower Heads	RESIDENTIAL TYPE		9.5	NO RETROFIT		9.5	245	1	0
ECO5 TOTAL:										
6	Water	40 GAL REPUBLIC #406		TEMP			TEMP		1	0
	Heater	CAPACITY: 38,000 BTU/H		325	REDUCE STORAGE TEMP		322	8760	1	
	(GAS)	RECOVERY: 32 GAL/HR			INSTALL INSUL JACKET		322	8760	1	
ECO6 TOTAL:										

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 450 A&B Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		47,520				1	\$0.20	\$8.83	\$8.83	\$9.70
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		47,520		0	0	1	\$0.20	\$8.83	\$8.83	\$9.70
3	Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$418.80
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$78.16	\$418.80
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	EST ANNUAL									
Water	HOT WTR					0.23		\$2.42	\$2.42	\$16.80
Heater	CONSUMPTION					7.70		\$80.96	\$80.96	\$60.00
(GAS)	(LITERS)									
	43,946									
ECO6 TOTAL:		43,946		0	0	8	\$0.00	\$83.38	\$83.38	\$76.80

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										10	
CALCULATION WORK SHEET 1										DATE: 5 OCT 94	
FACILITY NO. :		1426 A&B		FUNCTION:		UNACCOM PER'S HOUS DET FAC TYPICAL OF 46 UNITS					
Occupancy:		FAMILY		Operating Hours:		24					
ECO Number	ECO Type	Existing Fixture System		Retrofitted Fixture System		Usage	Fixtures	Water Leaks			
		Description	LPM	Description	LPM	HRS/YR	Quantity	Eliminated LPY			
1	Lavatory Sinks	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1				
ECO1 TOTAL:											
2	Misc. Sinks	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0			
		SERVICE SINK	22.7	INSTALL AERATOR	9.5	60	1				
ECO2 TOTAL:											
3	Water Closets	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	7300	2				
		FLUSH TYPE	17	3.5 GPF REPAIR KIT	13.2	14600	1				
ECO3 TOTAL :											
4	Urinals		LPF		LPF	#FL/YR	3	0			
ECO4 TOTAL :											
5	Shower Heads	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	0			
ECO5 TOTAL :											
6	Water	40 GAL RUUD			TEMP		1	0			
	Heater	CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1				
	(GAS)	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1				
ECO6 TOTAL :							1	0			

CALCULATION WORK SHEET 2

FACILITY NO.: 1426 A&B Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	Annual Water Saving LPY	Annual Energy Saving			WATER		Total	Total
ECO Type		ELEC KW	ELEC KWH	GAS MWH	Dollar Saving		Dollar Saving	Dollars Invested
1	0			0	\$0.00		\$0.00	\$0.00
Lavatory Sinks	0			0	\$0.00		\$0.00	\$0.00
	0			0	\$0.00		\$0.00	\$0.00
ECO1 TOTAL:	0	0	0	0	\$0.00		\$0.00	\$0.00
2	0			0	\$0.00		\$0.00	\$0.00
Misc. Sinks	47,520			1	\$0.20		\$8.83	\$9.70
	0			0	\$0.00		\$0.00	\$0.00
ECO2 TOTAL:	47,520	0	0	1	\$0.20		\$8.83	\$9.70
3	188,340				\$78.16		\$78.16	\$838.80
Water Closets	55,480				\$23.02		\$23.02	\$60.00
	0				\$0.00		\$0.00	\$0.00
ECO3 TOTAL:	243,820				\$101.19		\$101.19	\$898.80
4	0				\$0.00		\$0.00	\$0.00
Urinals	0				\$0.00		\$0.00	\$0.00
	0				\$0.00		\$0.00	\$0.00
ECO4 TOTAL:	0				\$0.00		\$0.00	\$0.00
5	0			0	\$0.00		\$0.00	\$0.00
Shower Heads	0			0	\$0.00		\$0.00	\$0.00
	0			0	\$0.00		\$0.00	\$0.00
ECO5 TOTAL:	0	0	0	0	\$0.00		\$0.00	\$0.00
6	EST ANNUAL							
Water	HOT WTR			0.89			\$9.37	\$16.80
Heater	CONSUMPTION			7.70			\$80.96	\$60.00
(GAS)	(LITERS)							
	43,946							
ECO6 TOTAL:	43,946	0	0	9	\$0.00		\$90.33	\$76.80

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

10

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO.: 1432 A FUNCTION: UNACCOM PERS HOUS DET FAC  
 Occupancy: FAMILY Operating Hours: 24  
TYPICAL OF 68 UNITS

ECO Number ECO Type	Existing Fixture System		Retrofited Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
	Description	LPM	Description	LPM			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2	
Lavatory Sinks							
ECO1 TOTAL:							
2	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0
Misc. Sinks							
ECO2 TOTAL:							
3	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	14600	1	
Water Closets							
ECO3 TOTAL:							
4		LPF		LPF	#FL/YR	1	0
Urinals							
ECO4 TOTAL:							
5	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	55640
Shower Heads							
ECO5 TOTAL:							
6	40 GAL RUUD	TEMP		TEMP		1	55640
Water							
	CAPACITY: ?	331	REDUCE STORAGE TEMP	322	8760	1	
Heater							
	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1	
(GAS)							
ECO6 TOTAL:						1	0

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

## CALCULATION WORK SHEET 2

FACILITY NO. : 1432 A      Water Rate: 0.42 \$/KL      Energy Rate: \$/KWH  
 Gas Rate: 10.51 \$/MWH      Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$418.80
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$78.16	\$418.80
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	55,640				96	\$23.09	\$1,034.18	\$1,034.18	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		55,640		0	0	96	\$23.09	\$1,034.18	\$1,034.18	\$0.00
6	EST ANNUAL									
Water	HOT WTR					0.68		\$7.11		
Heater	CONSUMPTION					7.70		\$80.96		\$60.00
(GAS)	(LITERS)									
		43,946								
ECO6 TOTAL:		43,946		0	0	8	\$0.00	\$88.07	\$88.07	\$60.00

SYSTEMS CORP

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

10

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO.: 4041 FUNCTION: UNACCOM PERS HOUS DET FAC  
TYPICAL OF 10 UNITS

Occupancy: FAMILY Operating Hours: 24

ECO Number ECO Type	Existing Fixture System		Retrofitted Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
	Description	LPM	Description	LPM			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1	
Lavatory Sinks							
ECO1 TOTAL:							
2	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	2	0
Misc. Sinks							
ECO2 TOTAL:							
3	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	14600	1	
Water Closets							
ECO3 TOTAL:							
4		LPF		LPF	#FL/YR	1	0
Urinals							
ECO4 TOTAL:							
5	RESIDENTIAL TYPE	5.68	NO RETROFIT	5.68	245	1	0
Shower Heads							
ECO5 TOTAL:							
6	40 GAL ? GLO 850	TEMP		TEMP		1	0
Water							
	CAPACITY: 30,500 BTU/H	334	REDUCE STORAGE TEMP	322	8760	1	
Heater							
	RECOVERY: 25.6 GAL/H		INSTALL INSUL JACKET	322	8760	1	
(GAS)							
ECO6 TOTAL:						1	0

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 4041 Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	Annual Water Saving LPY	Annual Energy Saving			WATER		Total	Total
ECO Type		ELEC KW	ELEC KWH	GAS MWH	Dollar Saving		Dollar Saving	Dollars Invested
1	0			0	\$0.00		\$0.00	\$0.00
Lavatory Sinks	0			0	\$0.00		\$0.00	\$0.00
	0			0	\$0.00		\$0.00	\$0.00
ECO1 TOTAL:	0	0	0	0	\$0.00		\$0.00	\$0.00
2	0			0	\$0.00		\$0.00	\$0.00
Misc. Sinks	0			0	\$0.00		\$0.00	\$0.00
	0			0	\$0.00		\$0.00	\$0.00
ECO2 TOTAL:	0	0	0	0	\$0.00		\$0.00	\$0.00
3	188,340				\$78.16		\$78.16	\$418.80
Water Closets	0				\$0.00		\$0.00	\$0.00
	0				\$0.00		\$0.00	\$0.00
ECO3 TOTAL:	188,340				\$78.16		\$78.16	\$418.80
4	0				\$0.00		\$0.00	\$0.00
Urinals	0				\$0.00		\$0.00	\$0.00
	0				\$0.00		\$0.00	\$0.00
ECO4 TOTAL:	0				\$0.00		\$0.00	\$0.00
5	0			0	\$0.00		\$0.00	\$0.00
Shower Heads	0			0	\$0.00		\$0.00	\$0.00
	0			0	\$0.00		\$0.00	\$0.00
ECO5 TOTAL:	0	0	0	0	\$0.00		\$0.00	\$0.00
6	EST ANNUAL							
Water	HOT WTR			0.89			\$9.37	
Heater	CONSUMPTION			7.70			\$80.96	\$60.00
(GAS)	(LITERS)							
	43,946							
ECO6 TOTAL:	43,946	0	0	9	\$0.00		\$90.33	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

10

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO.: 4096      FAMILY:      FUNCTION: UNACCOM PERS HOUS DET FAC  
TYPICAL OF 16 UNITS

Occupancy:      Operating Hours: 24

ECO Number ECO Type	Existing Fixture System		Retrofitted Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
	Description	LPM	Description	LPM			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1	
Lavatory Sinks							
ECO1 TOTAL:							
2	KITCHEN SINK	22.7	INSTALL AERATOR	9.5	365	1	0
Misc. Sinks	SERVICE SINK	22.7	INSTALL AERATOR	9.5	60	1	212.9
ECO2 TOTAL:							
3	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	14600	1	
Water Closets							
ECO3 TOTAL:							
4		LPF		LPF	#FL/YR	1	0
Urinals							
ECO4 TOTAL:							
5	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	0
Shower Heads							
ECO5 TOTAL:							
6	40 GAL NATIONAL	TEMP		TEMP		1	0
Water	CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1	
Heater	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1	
(GAS)							
ECO6 TOTAL:						1	0

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 4096 Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	Total
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving		
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	289,080				5	\$1.20	\$53.73	\$9.70	\$9.70
		47,733				1	\$0.20	\$8.87	\$9.70	\$9.70
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		336,813		0	0	6	\$1.40	\$62.60	\$19.40	\$19.40
3	Water Closets	188,340					\$78.16	\$78.16	\$418.80	\$418.80
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$418.80	\$418.80
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	EST ANNUAL									
	Water					0.89		\$9.37	\$16.80	\$16.80
	Heater					7.70		\$80.96	\$60.00	\$60.00
	(GAS)									
		43,946								
ECO6 TOTAL:		43,946		0	0	9	\$0.00	\$90.33	\$76.80	\$76.80

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

10

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO.: 4270 FUNCTION: UNACCOM PERS HOUS DET FAC  
TYPICAL OF 31 UNITS

Occupancy: FAMILY (4BR) Operating Hours: 24

ECO Number ECO Type	Existing Fixture System		Retrofitted Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
	Description	LPM	Description	LPM			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2	
Lavatory Sinks							
ECO1 TOTAL:							
2	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0
Misc. Sinks							
ECO2 TOTAL:							
3	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	14600	1	0
Water Closets							
ECO3 TOTAL:							
4		LPF		LPF	#FL/YR	1	0
Urinals							
ECO4 TOTAL:							
5	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	2	0
Shower Heads							
ECO5 TOTAL:							
6	40 GAL RHEEM	TEMP		TEMP		2	0
Water							
	CAPACITY: ?	325	REDUCE STORAGE TEMP	322	8760	1	
Heater							
	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1	
(GAS)							
ECO6 TOTAL:						1	0

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 4270 Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	Annual Water Saving	LPY	Annual Energy Saving			WATER		Total	Total
ECO Type			ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollars Invested	
1	0				0	\$0.00	\$0.00	\$0.00	
Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	
	0				0	\$0.00	\$0.00	\$0.00	
ECO1 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	
2	0				0	\$0.00	\$0.00	\$0.00	
Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	
	0				0	\$0.00	\$0.00	\$0.00	
ECO2 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	
3	188,340					\$78.16	\$78.16	\$418.80	
Water Closets	0					\$0.00	\$0.00	\$0.00	
	0					\$0.00	\$0.00	\$0.00	
ECO3 TOTAL:	188,340					\$78.16	\$78.16	\$418.80	
4	0					\$0.00	\$0.00	\$0.00	
Urinals	0					\$0.00	\$0.00	\$0.00	
	0					\$0.00	\$0.00	\$0.00	
ECO4 TOTAL:	0					\$0.00	\$0.00	\$0.00	
5	0				0	\$0.00	\$0.00	\$0.00	
Shower Heads	0				0	\$0.00	\$0.00	\$0.00	
	0				0	\$0.00	\$0.00	\$0.00	
ECO5 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	
6	EST ANNUAL								
Water	HOT WTR				0.25		\$2.66		
Heater	CONSUMPTION				7.70		\$80.96	\$60.00	
(GAS)	(LITERS)								
	43,946								
ECO6 TOTAL:	43,946		0	0	8	\$0.00	\$83.63	\$60.00	

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

10

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO.: 4358 FUNCTION: UNACCOM PERS HOUS DET FAC  
TYPICAL OF 39 UNITS

Occupancy: FAMILY Operating Hours: 24

ECO Number ECO Type	Existing Fixture System		Retrofited Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
	Description	LPM	Description	LPM			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2	
Lavatory Sinks							
ECO1 TOTAL:							
2	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0
Misc. Sinks							
ECO2 TOTAL:							
3	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	14600	1	
Water Closets							
ECO3 TOTAL:							
4		LPF		LPF	#FL/YR	1	0
Urinals							
ECO4 TOTAL:							
5	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	HRS/YR	0	0
Shower Heads							
ECO5 TOTAL:							
6	40 GAL RUUD	TEMP		TEMP		1	0
Water							
	CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1	
Heater							
	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1	
(GAS)							
ECO6 TOTAL:						1	0

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY												2 OF 2	
CALCULATION WORK SHEET 2													
FACILITY NO. : 4358		Water Rate:		0.42		\$/KL		Energy Rate:		\$/KWH			
Gas Rate:		10.51		\$/MWH		Demand Rate:		\$/KW					
ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total		Total		
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving		Dollar Saving		Dollars Invested		
1	Lavatory Sinks	0				0		\$0.00		\$0.00		\$0.00	
		0				0		\$0.00		\$0.00		\$0.00	
		0				0		\$0.00		\$0.00		\$0.00	
ECO1 TOTAL:		0		0	0	0		\$0.00		\$0.00		\$0.00	
2	Misc. Sinks	0				0		\$0.00		\$0.00		\$0.00	
		0				0		\$0.00		\$0.00		\$0.00	
		0				0		\$0.00		\$0.00		\$0.00	
ECO2 TOTAL:		0		0	0	0		\$0.00		\$0.00		\$0.00	
3	Water Closets	188,340						\$78.16		\$78.16		\$418.80	
		0						\$0.00		\$0.00		\$0.00	
		0						\$0.00		\$0.00		\$0.00	
ECO3 TOTAL:		188,340						\$78.16		\$78.16		\$418.80	
4	Urinals	0						\$0.00		\$0.00		\$0.00	
		0						\$0.00		\$0.00		\$0.00	
		0						\$0.00		\$0.00		\$0.00	
ECO4 TOTAL:		0						\$0.00		\$0.00		\$0.00	
5	Shower Heads	0				0		\$0.00		\$0.00		\$0.00	
		0				0		\$0.00		\$0.00		\$0.00	
		0				0		\$0.00		\$0.00		\$0.00	
ECO5 TOTAL:		0		0	0	0		\$0.00		\$0.00		\$0.00	
6	Water Heater (GAS)	EST ANNUAL											
		HOT WTR											
		CONSUMPTION											
		(LITERS)											
		43,946											
ECO6 TOTAL:		43,946		0	0	0		\$0.00		\$90.33		\$60.00	

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WAT CONSERVATION STUDY										10
CALCULATION WORK SHEET 1										DATE: 5 OCT 94
FACILITY NO. :		4363 B		FUNCTION:		UNACCOM PERS HOUS DET FAC				
Occupancy:		FAMILY		Operating Hours:		TYPICAL OF 48 UNITS				
						24				
ECO Number	ECO Type	Existing Fixture System		Retrofited Fixture System		Usage	Fixtures	Water Leaks		
		Description	LPM	Description	LPM	HRS/YR	Quantity	Eliminated LPY		
1	Lavatory Sinks	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1			
ECO1 TOTAL:										
2	Misc. Sinks	KITCHEN SINK	LPM	NO RETROFIT	9.5	365	1	0		
ECO2 TOTAL:										
3	Water Closets	TANK TYPE	LPF	1.6 GPF TANK TYPE TOILET	6.1	14600	1	0		
ECO3 TOTAL :										
4	Urinals		LPF				1	0		
ECO4 TOTAL :										
5	Shower Heads	RESIDENTIAL TYPE	LPM	NO RETROFIT	9.5	245	1	0		
ECO5 TOTAL :										
6	Water	40 GAL RHEEM/FURY	TEMP		TEMP		1	0		
	Heater	CAPACITY: ?	325	REDUCE STORAGE TEMP	322	8760	1			
	(GAS)	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1			
ECO6 TOTAL :							1	0		

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 4363 B Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	Annual Water		Annual Energy Saving			WATER		Total	
	Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	0				0	\$0.00	\$0.00	\$0.00	\$0.00
Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	0				0	\$0.00	\$0.00	\$0.00	\$0.00
Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	188,340					\$78.16	\$78.16	\$78.16	\$418.80
Water Closets	0					\$0.00	\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:	188,340					\$78.16	\$78.16	\$78.16	\$418.80
4	0					\$0.00	\$0.00	\$0.00	\$0.00
Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:	0					\$0.00	\$0.00	\$0.00	\$0.00
5	0				0	\$0.00	\$0.00	\$0.00	\$0.00
Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	EST ANNUAL								
Water	HOT WTR				0.25		\$2.66	\$2.66	
Heater	CONSUMPTION				7.70		\$80.96	\$80.96	\$60.00
(GAS)	(LITERS)								
	43,946								
ECO6 TOTAL:	43,946		0	0	8	\$0.00	\$83.63	\$83.63	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										10
CALCULATION WORK SHEET 1										DATE: 5 OCT 94
FACILITY NO.:		5314 D		FUNCTION:		UNACCOM PERS HOUS DET FAC				
Occupancy:		FAMILY		Operating Hours:		TYPICAL OF 298 UNITS				
						24				
ECO Number	ECO Type	Existing Fixture System		Retrofited Fixture System		Usage	Fixtures	Water Leaks		
		Description	LPM	Description	LPM	HRS/YR	Quantity	Eliminated LPY		
1	Lavatory Sinks	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2			
ECO1 TOTAL:	2	KITCHEN SINK	LPM		LPM		2	0		
Misc. Sinks			9.5	NO RETROFIT	9.5	365	1	0		
ECO2 TOTAL:	3	TANK TYPE	LPF		LPF	#FL/YR	1	0		
Water Closets			19	1.6 GPF TANK TYPE TOILET	6.1	14600	1			
ECO3 TOTAL:	4		LPF		LPF	#FL/YR	1	0		
Urinals										
ECO4 TOTAL:	5	RESIDENTIAL TYPE	LPM		LPM	HRS/YR	0	0		
Shower Heads			9.5	NO RETROFIT	9.5	245	1	55640		
ECO5 TOTAL:	6	40 GAL FURY	TEMP		TEMP		1	55640		
Water		CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1			
Heater		RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1			
(GAS)										
ECO6 TOTAL:							1	0		

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 5314 D Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$418.80
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$78.16	\$418.80
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	55,640				96	\$23.09	\$1,034.18	\$1,034.18	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		55,640		0	0	96	\$23.09	\$1,034.18	\$1,034.18	\$0.00
6	EST ANNUAL									
Water	HOT WTR					0.89		\$9.37		
Heater	CONSUMPTION					7.70		\$80.96		\$60.00
(GAS)	(LITERS)									
	43,946									
ECO6 TOTAL:		43,946		0	0	9	\$0.00	\$90.33	\$90.33	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

10

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO.: 5475 D FUNCTION: UNACCOM PERS HOUS DET FAC  
TYPICAL OF 255 UNITS

Occupancy: FAMILY Operating Hours: 24

ECO Number ECO Type	Existing Fixture System		Retrofited Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
	Description	LPM	Description	LPM			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2	
Lavatory Sinks							
ECO1 TOTAL:							
2	KITCHEN SINK	LPM		LPM		2	0
Misc. Sinks							
		9.5	NO RETROFIT	9.5	365	1	0
ECO2 TOTAL:							
3	TANK TYPE	LPF		LPF	#FL/YR	1	0
Water Closets							
		19	1.6 GPF TANK TYPE TOILET	6.1	7300	2	
ECO3 TOTAL:							
4		LPF		LPF	#FL/YR	2	0
Urinals							
ECO4 TOTAL:							
5	RESIDENTIAL TYPE	LPM		LPM	HRS/YR	0	0
Shower Heads							
		9.5	NO RETROFIT	9.5	245	1	0
ECO5 TOTAL:							
6		TEMP		TEMP		1	0
Water							
	40 GAL A. O. SMITH						
Heater							
	CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1	
	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1	
	(GAS)						
ECO6 TOTAL:						1	0

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 5475 D      Water Rate: 0.42 \$/KL      Energy Rate: \$/KWH  
 Gas Rate: 10.51 \$/MWH      Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$838.80
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$78.16	\$838.80
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	Water	EST ANNUAL								
	Heater	HOT WTR				0.89		\$9.37		
	(GAS)	CONSUMPTION				7.70		\$80.96		\$60.00
		(LITERS)								
		43,946								
ECO6 TOTAL:		43,946		0	0	9	\$0.00	\$90.33	\$90.33	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										10
CALCULATION WORK SHEET 1										DATE: 5 OCT 94
FACILITY NO.:		7549 A&B		FUNCTION:		UNACCOM PERS HOUS DET FAC				
Occupancy:		FAMILY		Operating Hours:		TYPICAL OF 110 UNITS				
						24				
ECO Number	ECO Type	Existing Fixture System		Retrofited Fixture System		Usage	Fixtures	Water Leaks		
		Description	LPM	Description	LPM	HRS/YR	Quantity	Eliminated LPY		
1	Lavatory Sinks	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1			
ECO1 TOTAL:										
2	Misc. Sinks	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0		
ECO2 TOTAL:										
3	Water Closets	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	7300	2			
ECO3 TOTAL:										
4	Urinals									
ECO4 TOTAL:										
5	Shower Heads	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	0		
ECO5 TOTAL:										
6	Water	40 GAL RHEEM/FURY #354					1	0		
	Heater	CAPACITY: 48,000 BTU/H	331	REDUCE STORAGE TEMP	322	8760	1			
	(GAS)	RECOVERY: 40.3 GAL/H		INSTALL INSUL JACKET	322	8760	1			
ECO6 TOTAL:							1	0		

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 7549 A&B      Water Rate: 0.42 \$/KL      Energy Rate: \$/KWH  
 Gas Rate: 10.51 \$/MWH      Demand Rate: \$/KW

ECO Number	Annual Water Saving	LPY	Annual Energy Saving			WATER		Total	Total
ECO Type			ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollars Invested	
1	0				0	\$0.00	\$0.00	\$0.00	\$0.00
Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	0				0	\$0.00	\$0.00	\$0.00	\$0.00
Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	188,340					\$78.16	\$78.16	\$838.80	\$838.80
Water Closets	0					\$0.00	\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:	188,340					\$78.16	\$78.16	\$838.80	\$838.80
4	0					\$0.00	\$0.00	\$0.00	\$0.00
Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:	0					\$0.00	\$0.00	\$0.00	\$0.00
5	0				0	\$0.00	\$0.00	\$0.00	\$0.00
Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	EST ANNUAL								
Water	HOT WTR				0.68		\$7.11		
Heater	CONSUMPTION				7.70		\$80.96		\$60.00
(GAS)	(LITERS)								
	43,946								
ECO6 TOTAL:	43,946		0	0	8	\$0.00	\$88.07	\$60.00	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										100	
CALCULATION WORK SHEET 1										DATE: 5 OCT 94	
FACILITY NO.:		7750 A		FUNCTION:		UNACCOM PERS HOUS DET FAC TYPICAL OF 45 UNITS					
Occupancy:		FAMILY		Operating Hours:		24					
ECO Number	ECO Type	Existing Fixture System		Retrofited Fixture System		Usage	Fixtures	Water Leaks			
		Description	LPM	Description	LPM	HRS/YR	Quantity	Eliminated LPY			
1	Lavatory Sinks	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1				
ECO1 TOTAL:			LPM		LPM		1	0			
2	Misc. Sinks	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0			
ECO2 TOTAL:			LPM		LPM						
3	Water Closets	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	14600	1	0			
ECO3 TOTAL:			LPM		LPM		1	0			
4	Urinals										
ECO4 TOTAL:			LPM		LPM		0	0			
5	Shower Heads	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	222558			
ECO5 TOTAL:			TEMP		TEMP		1	222558			
6	Water	40 GAL AMER. APP. #T-340									
	Water	CAPACITY: 30,000 BTU/H	334	REDUCE STORAGE TEMP	322	8760	1				
	Heater	RECOVERY: 7.7 GAL/H		INSTALL INSUL JACKET	322	8760	1				
	(GAS)										
ECO6 TOTAL:							1	0			

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 7750 A Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	Annual Water		Annual Energy Saving			WATER		Total	
	Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	0				0	\$0.00	\$0.00	\$0.00	\$0.00
Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:	0	0	0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	0				0	\$0.00	\$0.00	\$0.00	\$0.00
Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:	0	0	0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	188,340					\$78.16	\$78.16	\$78.16	\$418.80
Water Closets	0					\$0.00	\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:	188,340					\$78.16	\$78.16	\$78.16	\$418.80
4	0					\$0.00	\$0.00	\$0.00	\$0.00
Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:	0					\$0.00	\$0.00	\$0.00	\$0.00
5	222,558				385	\$92.36	\$4,136.66	\$4,136.66	\$0.00
Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:	222,558	0	0	0	385	\$92.36	\$4,136.66	\$4,136.66	\$0.00
6	EST ANNUAL								
Water	HOT WTR				0.89		\$9.37	\$9.37	
Heater	CONSUMPTION				7.70		\$80.96	\$80.96	\$60.00
(GAS)	(LITERS)								
	43,946								
ECO6 TOTAL:	43,946	0	0	0	9	\$0.00	\$90.33	\$90.33	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										10
CALCULATION WORK SHEET 1										DATE: 5 OCT 94
FACILITY NO.:		7751 C		FUNCTION:		UNACCOM PERS HOUS DET FAC				
Occupancy:		FAMILY		Operating Hours:		TYPICAL OF 254 UNITS				
						24				
ECO Number	Existing Fixture System	Retrofited Fixture System	Usage	Fixtures	Water Leaks					
ECO Type	Description	LPM	Description	LPM	HRS/YR	Quantity	Eliminated LPY			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1				
Lavatory Sinks										
ECO1 TOTAL:						1	0			
2	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0			
Misc. Sinks										
ECO2 TOTAL:						1	0			
3	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	14600	1				
Water Closets										
ECO3 TOTAL:						1	0			
4										
Urinals										
ECO4 TOTAL:						0	0			
5	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	0			
Shower Heads										
ECO5 TOTAL:						1	0			
6	40 GAL AMER. APP. #T-340			TEMP						
Water	CAPACITY: 30,000 BTU/H	334	REDUCE STORAGE TEMP	322	8760	1				
Heater	RECOVERY: 7.7 GAL/H		INSTALL INSUL JACKET	322	8760	1				
(GAS)										
ECO6 TOTAL:						1	0			

**SYSTEMS CORP** Systems Engineering and Management Corporation, Knoxville, TN

## CALCULATION WORK SHEET 2

FACILITY NO.: 7751 C Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number ECO Type	Annual Water		Annual Energy Saving			WATER		Total	
	Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1 Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2 Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3 Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$418.80
	0					\$0.00	\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:	188,340					\$78.16	\$78.16	\$78.16	\$418.80
4 Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:	0					\$0.00	\$0.00	\$0.00	\$0.00
5 Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6 Water Heater (GAS)	EST ANNUAL HOT WTR CONSUMPTION (LITERS) 43,946				0.89 7.70		\$9.37 \$80.96		\$60.00
ECO6 TOTAL:	43,946		0	0	9	\$0.00	\$90.33	\$90.33	\$60.00

SYSTEMS CORP

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										10
CALCULATION WORK SHEET 1										DATE: 5 OCT 94
FACILITY NO.:		7821 B		FUNCTION:		UNACCOM PERS HOUS DET FAC				
Occupancy:		FAMILY		Operating Hours:		TYPICAL OF 82 UNITS				
						24				
ECO Number	ECO Type	Existing Fixture System		Retrofited Fixture System		Usage	Fixtures	Water Leaks		
		Description	LPM	Description	LPM	HRS/YR	Quantity	Eliminated LPY		
1	Lavatory Sinks	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1			
ECO1 TOTAL:										
2	Misc. Sinks	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0		
ECO2 TOTAL:										
3	Water Closets	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	14600	1	0		
ECO3 TOTAL:										
4	Urinals									
ECO4 TOTAL:										
5	Shower Heads	RESIDENTIAL TYPE	11.4	NO RETROFIT	11.4	245	1	0		
ECO5 TOTAL:										
6	Water	40 GAL RHEEM/FURY			TEMP		1	0		
	Heater	CAPACITY: ?	336	REDUCE STORAGE TEMP	322	8760	1			
	(GAS)	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1			
ECO6 TOTAL:							1	0		

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

## CALCULATION WORK SHEET 2

FACILITY NO.: 7821 B Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	Annual Water		Annual Energy Saving			WATER	Total	Total
	Saving	LPY	ELEC KW	ELEC KWH	GAS MWH			
1	0				0	\$0.00	\$0.00	\$0.00
Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00
2	0				0	\$0.00	\$0.00	\$0.00
Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00
3	188,340					\$78.16	\$78.16	\$418.80
Water Closets	0					\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00
ECO3 TOTAL:	188,340					\$78.16	\$78.16	\$418.80
4	0					\$0.00	\$0.00	\$0.00
Urinals	0					\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00
ECO4 TOTAL:	0					\$0.00	\$0.00	\$0.00
5	0				0	\$0.00	\$0.00	\$0.00
Shower Heads	0				0	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00
6	EST ANNUAL							
Water	HOT WTR				1.10		\$11.61	
Heater	CONSUMPTION				7.70		\$80.96	\$60.00
(GAS)	(LITERS)							
	43,946							
ECO6 TOTAL:	43,946		0	0	9	\$0.00	\$92.57	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										10
CALCULATION WORK SHEET 1										DATE: 5 OCT 94
FACILITY NO.: 7869 A		FUNCTION: UNACCOM PERS HOUS DET FAC		TYPICAL OF 84 UNITS						
Occupancy: FAMILY		Operating Hours: 24								
ECO Number	ECO Type	Existing Fixture System	Description	Retrofitted Fixture System	Usage	Fixtures	Water Leaks			
1	Lavatory Sinks	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1			
		SINK W/O AERATOR	22.7	INSTALL AERATOR	9.5	125	1			
ECO1 TOTAL:										
2	Misc. Sinks	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1			0
ECO2 TOTAL:										
3	Water Closets	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	7300	2			0
ECO3 TOTAL:										
4	Urinals									
ECO4 TOTAL:										
5	Shower Heads	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1			0
ECO5 TOTAL:										
6	Water	40 GAL RHEEM			TEMP		1			0
		CAPACITY: 30,000 BTU/H	332	REDUCE STORAGE TEMP	322	8760	1			
	Heater	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1			
	(GAS)									
ECO6 TOTAL:							1			0

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 7869 A Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	Annual Water Saving LPY	Annual Energy Saving			WATER		Total	Total
ECO Type		ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1				0	\$0.00	\$0.00	\$0.00	\$0.00
Lavatory Sinks	99,000			171	\$41.09	\$1,840.10	\$1,840.10	\$9.70
	0			0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:	99,000	0	0	171	\$41.09	\$1,840.10	\$1,840.10	\$9.70
2				0	\$0.00	\$0.00	\$0.00	\$0.00
Misc. Sinks	0			0	\$0.00	\$0.00	\$0.00	\$0.00
	0			0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:	0	0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3					\$78.16	\$78.16	\$78.16	\$838.80
Water Closets	0				\$0.00	\$0.00	\$0.00	\$0.00
	0				\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:	188,340				\$78.16	\$78.16	\$78.16	\$838.80
4					\$0.00	\$0.00	\$0.00	\$0.00
Urinals	0				\$0.00	\$0.00	\$0.00	\$0.00
	0				\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:	0				\$0.00	\$0.00	\$0.00	\$0.00
5				0	\$0.00	\$0.00	\$0.00	\$0.00
Shower Heads	0			0	\$0.00	\$0.00	\$0.00	\$0.00
	0			0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:	0	0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	EST ANNUAL							
Water	HOT WTR			0.76		\$8.02	\$8.02	\$16.80
Heater	CONSUMPTION			7.70		\$80.96	\$80.96	\$60.00
(GAS)	(LITERS)							
	43,946							
ECO6 TOTAL:	43,946	0	0	8	\$0.00	\$88.98	\$88.98	\$76.80

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										10
CALCULATION WORK SHEET 1										DATE: 5 OCT 94
FACILITY NO. : 9053 B		FUNCTION: UNACCOM PERS HOUS DET FAC		TYPICAL OF 327 UNITS						
Occupancy: FAMILY		Operating Hours: 24								
ECO Number	ECO Type	Existing Fixture System		Retrofited Fixture System		Usage	Fixtures	Water Leaks		
		Description	LPM	Description	LPM	HRS/YR	Quantity	Eliminated LPY		
1	Lavatory Sinks	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2			
ECO1 TOTAL:										
2	Misc. Sinks	KITCHEN SINK	LPM	NO RETROFIT	9.5	365	1	0		
ECO2 TOTAL:										
3	Water Closets	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	7300	2	0		
ECO3 TOTAL :										
4	Urinals		LPM				2	0		
ECO4 TOTAL :										
5	Shower Heads	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	55640		
ECO5 TOTAL :										
6	Water	40 GAL RUUD #P40-7			TEMP		1	55640		
Heater		CAPACITY: ?	345	REDUCE STORAGE TEMP	322	8760	1			
(GAS)		RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1			
ECO6 TOTAL :							1	0		

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

## FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

## CALCULATION WORK SHEET 2

FACILITY NO.: 9053 B Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total		Total	
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving		Dollar Saving		Dollars Invested	
1	Lavatory Sinks	0				0	\$0.00		\$0.00		\$0.00	
		0				0	\$0.00		\$0.00		\$0.00	
		0				0	\$0.00		\$0.00		\$0.00	
ECO1 TOTAL:		0		0	0	0	\$0.00		\$0.00		\$0.00	
2	Misc. Sinks	0				0	\$0.00		\$0.00		\$0.00	
		0				0	\$0.00		\$0.00		\$0.00	
		0				0	\$0.00		\$0.00		\$0.00	
ECO2 TOTAL:		0		0	0	0	\$0.00		\$0.00		\$0.00	
3	Water Closets	188,340					\$78.16		\$78.16		\$838.80	
		0					\$0.00		\$0.00		\$0.00	
		0					\$0.00		\$0.00		\$0.00	
ECO3 TOTAL:		188,340					\$78.16		\$78.16		\$838.80	
4	Urinals	0					\$0.00		\$0.00		\$0.00	
		0					\$0.00		\$0.00		\$0.00	
		0					\$0.00		\$0.00		\$0.00	
ECO4 TOTAL:		0					\$0.00		\$0.00		\$0.00	
5	Shower Heads	55,640				96	\$23.09		\$1,034.18		\$0.00	
		0				0	\$0.00		\$0.00		\$0.00	
		0				0	\$0.00		\$0.00		\$0.00	
ECO5 TOTAL:		55,640		0	0	96	\$23.09		\$1,034.18		\$0.00	
6	EST ANNUAL											
Water	HOT WTR					1.75			\$18.35			
Heater	CONSUMPTION					7.70			\$80.96		\$60.00	
(GAS)	(LITERS)											
		43,946										
ECO6 TOTAL:		43,946		0	0	9	\$0.00		\$99.31		\$60.00	

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										10
CALCULATION WORK SHEET 1										DATE: 5 OCT 94
FACILITY NO.:		9141 A&B		FUNCTION:		UNACCOM PERS HOUS DET FAC				
Occupancy:		FAMILY		Operating Hours:		TYPICAL OF 87 UNITS				
						24				
ECO Number	ECO Type	Existing Fixture System		Retrofited Fixture System		Usage	Fixtures	Water Leaks		
		Description	LPM	Description	LPM	HRS/YR	Quantity	Eliminated LPY		
1	Lavatory Sinks	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1			
		SINK W/O AERATOR	22.7	INSTALL AERATOR	9.5	125	1			
ECO1 TOTAL:			LPM		LPM		2	0		
2	Misc. Sinks	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0		
ECO2 TOTAL:			LPF		LPF	#FL/YR	1	0		
3	Water Closets	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	14600	1			
ECO3 TOTAL :			LPF		LPF	#FL/YR	1	0		
4	Urinals									
ECO4 TOTAL :			LPM		LPM	HRS/YR	0	0		
5	Shower Heads	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	0		
ECO5 TOTAL :			TEMP		TEMP		1	0		
6	Water	40 GAL RHEEM/FURY								
	Water	CAPACITY: ?	328	REDUCE STORAGE TEMP	322	8760	1			
	Heater	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1			
	(GAS)									
ECO6 TOTAL :							1	0		

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 9141 A&B  
 Water Rate: 0.42 \$/KL Energy Rate: \$/KWH  
 Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	Annual Water Saving	LPY	Annual Energy Saving			WATER		Total	Total
ECO Type			ELEC KW	ELEC KWH	GAS MWH	Dollar Saving		Dollar Saving	Dollars Invested
1									
Lavatory Sinks	0				0	\$0.00		\$0.00	\$0.00
	99,000				2	\$0.41		\$18.40	\$9.70
	0				0	\$0.00		\$0.00	\$0.00
ECO1 TOTAL:	99,000		0	0	2	\$0.41		\$18.40	\$9.70
2									
Misc. Sinks	0				0	\$0.00		\$0.00	\$0.00
	0				0	\$0.00		\$0.00	\$0.00
	0				0	\$0.00		\$0.00	\$0.00
ECO2 TOTAL:	0		0	0	0	\$0.00		\$0.00	\$0.00
3									
Water Closets	188,340					\$78.16		\$78.16	\$418.80
	0					\$0.00		\$0.00	\$0.00
	0					\$0.00		\$0.00	\$0.00
ECO3 TOTAL:	188,340					\$78.16		\$78.16	\$418.80
4									
Urinals	0					\$0.00		\$0.00	\$0.00
	0					\$0.00		\$0.00	\$0.00
	0					\$0.00		\$0.00	\$0.00
ECO4 TOTAL:	0					\$0.00		\$0.00	\$0.00
5									
Shower Heads	0				0	\$0.00		\$0.00	\$0.00
	0				0	\$0.00		\$0.00	\$0.00
	0				0	\$0.00		\$0.00	\$0.00
ECO5 TOTAL:	0		0	0	0	\$0.00		\$0.00	\$0.00
6									
Water	EST ANNUAL								
Heater	HOT WTR				0.46			\$4.88	\$16.80
(GAS)	CONSUMPTION				7.70			\$80.96	\$60.00
	(LITERS)								
	43,946								
ECO6 TOTAL:	43,946		0	0	8	\$0.00		\$85.84	\$76.80

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

## 4 *ECIP PROJECT 2*

*FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY*

This section contains the project description and the DD1391 forms for ECIP Project FH-2, Family Housing Water Conservation Phase II improvements to 1,602 Family Housing Units. Two lists of the buildings included in the project follow the DD1391 forms. The first list includes all buildings considered in the project in numerical order. The second list shows which buildings were used to model unsurveyed buildings. Following these lists are the LCCID report and the cost estimate for the proposed project. Calculation sheets for the individual buildings follow the project cost estimate. Below is a detailed index of the information included in this section.

DD1391 Form .....	4-2
Table 4.1 - ECIP FH-2 - Family Housing .....	4-6
Table 4.2 - Buildings Modeled by Surveyed Buildings .....	4-7
Project LCCID Report .....	4-8
Catalog Cut Sheets/Product Information .....	4-9
Project Cost Estimate .....	4-10
Building Calculation Sheets .....	4-13

DATE: 22 December 1994  
PROJECT NO.: ECIP-FH2  
PROJECT TITLE: Family Housing Water Conservation Phase II  
INSTALLATION: Fort Knox  
LOCATION: Kentucky

PRIMARY FACILITY  
Water Closets \$993,000

ESTIMATED CONTRACT COST	\$820,000
CONTINGENCY PERCENT (10%)	82,000
SUBTOTAL	902,000
SUPERVISION, INSPECTION & OVERHEAD (5%)	45,100
DESIGN COST	45,100
TOTAL REQUEST	992,200
TOTAL REQUEST (ROUNDED)	\$993,000

Replace water closets in 1602 family housing units with water saving, 6 liters (1.6 gallons) per flush water closets. All water closets will be of the flush tank type. The project will significantly reduce potable water consumption and sanitary waste production.

DATE: 22 December 1994  
PROJECT NO.: ECIP-FH2  
PROJECT TITLE: Family Housing Water Conservation Phase II  
INSTALLATION: Fort Knox  
LOCATION: Kentucky

PROJECT:

Replace water closets in 1602 family housing units with water saving, 6 liters (1.6 gallons) per flush water closets.

REQUIREMENTS:

Fort Knox utilizes inefficient outdated water closets in its family housing units. The existing water closets consume significantly more water and generate greater quantities of sanitary waste per flush than the new standard water saving water closet. The existing inefficient systems place greater demand on the water table, water treatment plant and waste treatment plant. The U.S. Army Corp of Engineers, Louisville District, contracted an Energy Engineering Analysis Program (EEAP) Water Conservation Study of the Post. The study identified energy and water conservation opportunities. Life cycle cost analysis was performed on each opportunity to determine its discounted savings-to - investment ratio (SIR) and estimated payback period. This project has a SIR of 2.61 and a simple payback period of 5.68 years. The project exceeds the minimum requirements of an SIR greater than 1.25 and a simple payback of less than 10 years.

CURRENT SITUATION:

The family housing units at Ft. Knox have inefficient water closets. The family housing units consume more water and generate more sanitary waste than is necessary. The new water closets will greatly reduce the water consumption and waste generated.

IMPACT IF NOT PROVIDED:

If this project is not implemented, 1602 family housing units will continue to consume more water and generate more waste than necessary. The U.S. Army will fail to realize an estimated \$175K in annual savings (FY95\$) and a total discounted savings of \$2.59M during the twenty year life of the project.

ADDITIONAL:

A life cycle cost analysis was performed on the project. The project will realize water savings of over 2.6 times the initial investment cost and will pay for itself in less than 5.7 years.

Ft. Knox is not on the list of installations considered for closure or realignment.

DATE: 22 December 1994  
PROJECT NO.: ECIP-FH2  
PROJECT TITLE: Family Housing Water Conservation Phase II  
INSTALLATION: Fort Knox  
LOCATION: Kentucky

## SECTION 11 - ECONOMIC ANALYSIS DATA

### 11D ECONOMIC JUSTIFICATION SUMMARY

This water conservation project is recommended for funding. A life cycle cost analysis was performed on each portion of this project and on the overall project. The overall project will realize water savings of over 2.6 times the initial investment cost and will pay for itself in less than 5.7 years.

TABLE 4.1 ECIP FH-2 - FAMILY HOUSING

4402 A-D	4518 A-H	4888 A-D	5300 A-H - 5370 A-H
4404 A-L	4521 A-E	4889 A-F	5310 A-H
4408 A-D	4801 A-D	4891 A-F	5311 A-H
4410 A-C, E-F	4802 A-F	4894 A-F	5314 A-C, E-H
4413 A-D	4804 A-C	4897 A-D	5315 A-H - 5317 A-H
4414 A-F	4806 A-D	4898 A-D	5320 A-H - 5330 A-H
4417 A-D	4807 A-D	4899 A-F	5334 A-H
4418 A-L	4808 A-F	4902 A-D	5336 A-H
4422 A-D	4810 A-F	4903 A-D	5337 A-H
4423 A-L	4811 A-D	4904 A-F	5339 A-H
4427 A-L	4813 A-D	4907 A-D	5340 A-H
4431 A-F	4814 A-D	4908 A-L	5342 A-H
4434 A-F	4816 A-D	4913 A-D	5344 A-H
4437 A-F	4818 A-D	4914 A-H	5346 A-H - 5349 A-H
4439 A-L	4820 A-D	4916 A-F	5351 A-H - 5353 A-E
4443 A-D	4822 A-D	4917 A-D	5353
4444 A-D	4822 A-D	4918 A, C-L	5353 G-H - 5358 A-H
4446 A-L	4823 A-D	4921 A-L	5364 A-H - 5368 A-H
4450 A-C, E-L	4824 A-H	4925 A-D	5370 A-H
4454 A-D	4827 A-F	4926 A-L	5400 A-H
4455 A-D	4829 A-L	4930 A-D	5406 A-D
4456	4833 A-L	4931 A-F	5406 F-H - 5409 A-H
4456 A-L	4837 A-D	4934 A-E	5411 A-H - 5413 A-H
4460 A-L	4838 A-L	4936 A-L	5415 A-H
4464 A-D	4842 A, C-F	4940 A-F	5417 A-H
4465 A-D	4844 A-L	4942 A-L	5419 A-H - 5422 A-H
4466 A-E	4848 A-F	4946 A-D	5425 A-H
4468 A-D	4850 A-L	4947 A-F	5427 A-H
4469 A-D	4854 A-D	4950 A-D	5430 A-H
4471 A-D - 4473 A-D	4855 A-D	4951 A-L	5432 A-H - 5436 A-H
4474 A-D	4856 A-F	4955 A-D	5438 A-H
4476 A-L	4859	4957 A-L	5441 A-H
4480 A-L	4859 B-D - 4861 A-D	4963 A-L	5442 A-H
4484 A-E	4862 A-F	4967 A-F	5444 A-H
4486 A-D	4865 A-H	4969 A-K	5446 A-H
4488 A-L	4868 A-F	4973 A-D	5447 A-H
4492 A-L	4870	4974 A-F	5449 A-H
4496	4870 A-L	49*76 A-D	5450 A-H
4496 B-D - 4498 A-D	4874 A-D	4977 A-F	5452 A-H
4499 A-L	4875 A-K	4979 A-F	5454 A-H
4503 A, C-D	4879 A-D	4981 A-F	5455 A-H
4504 A-L	4880 A-F	4984 A-D	5457 A-H - 5459 A-H
4508 A-L	4883 A-D	4985 A-DE	5461 A-H
4512 A-H	4884 A-F	4987 A-F	
4515 A-F	4887 A-D		

TABLE 4.2 BUILDINGS MODELED BY SURVEYED BUILDINGS

BUILDINGS SURVEYED AND CALCULATED	BUILDINGS ASSUMED TYPICAL OF SURVEYED BUILDINGS
5353	5300A-H - 5307A-H, 5310A-H, 5311A-H, 5314A-C & E-H, 5315A-H - 5317A-H, 5320A-H - 5330A-H, 5334A-H, 5336A-H, 5337A-H, 539A-H, 5340A-H, 5342A-H, 5344A-H, 5346A-H - 5349A-H, 5351A-H - 5353A-E, 5353G-H - 5358A-H, 5364A-H - 5368A-H, 5370A-H, 5400A-H - 5406A-D, 5406F-H - 5409A-H, 5411A-H - 5413A-H, 5415A-H, 5417A-H, 5419A-H - 5422A-H, 5425A-H, 5427A-H, 5430A-H, 5432A-H, 5446A-H, 5447A-H, 5449A-H, 5450A-H, 5452A-H, 5454A-H, 5455A-H, 5457A-H - 5459A-H, 5461A-H
4456	4402A-D, 4404A-L, 4408A-D, 4410A-C & E-F, 4414A-F, 4418A-L, 4423A-L, 4427A-F, 4431A-F, 4434A-F, 4437A-F, 4439A-L, 4444A-D, 4446A-L, 4450A-C & E-L, 4456A-L, 4460A-L, 4466A-E, 4469A-D, 4474A-D, 4476A-L, 4480A-L, 4484A-E, 4486A-D, 4488A-L, 4492A-L, 4499A-L, 4504A-L, 4508A-L, 4512A-H, 4515A-F, 4518A-H, 4521A-E
4496	4413A-D, 4417A-D, 4422A-D, 4443A-D, 4454A-D, 4455A-D, 4464A-D, 4465A-D, 4468A-D, 4471A-D - 4473A-D, 4496B-D - 4498A-D, 4503A & C-D
4859	4801A-D, 4806A-D, 4807A-D, 4811A-D, 4813A-D, 4822A-D, 4822A-D, 4823A-D, 4837A-D, 4854A-D, 4855A-D, 4859B-D - 4861A-D, 4879A-D, 4883A-D, 4887A-D, 4888A-D, 4897A-D, 4898A-D, 4902A-D, 4903A-D, 4907A-D, 4913A-D, 4917A-D, 4925A-D, 4930A-D, 4946A-D, 4950A-D, 4973A-D, 4976A-D, 4984A-D
4870	4802A-F, 4804A-C, 4808A-F, 4810A-F, 4814A-D, 4816A-D, 4818A-D, 4820A-D, 4824A-H, 4827A-F, 4829A-L, 4833A-L, 4838A-L, 4824A & C-F, 4844A-L, 4848A-F, 4850A-L, 4856A-F, 4826A-F, 4865A-H, 4868A-F, 4870A-L, 4874A-D, 4875A-K, 4880A-F, 4884A-F, 4889A-F, 4891A-F, 4894A-F, 4899A-F, 4904A-F, 4908A-L, 4914A-H, 4918A & C-L, 4921A-L, 4926A-L, 4931A-F, 4934A-E, 4936A-L, 4940A-F, 4942A-L, 4947A-F, 4951A-L, 4955A-D, 4957A-L, 4961A-F, 4963A-L, 4967A-F, 4969A-K, 4974A-F, 4977A-F, 4979A-F, 4981A-F, 4985A-D, 4987A-F

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: ECIP-FH2

LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT KNOX REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: ECIP-FH2 FAMILY HOUSING PROJECT 2

FISCAL YEAR 1995 DISCRETE PORTION NAME: WATER

ANALYSIS DATE: 12-27-94 ECONOMIC LIFE 20 YEARS PREPARED BY: DERRINGTON

1. INVESTMENT

A. CONSTRUCTION COST	\$	902000.	
B. SIOH	\$	45100.	
C. DESIGN COST	\$	45100.	
D. TOTAL COST (1A+1B+1C)	\$	992200.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		992200.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH (1)	SAVINGS MWH/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 46.40	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 10.51	0.	\$ 0.	18.58	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		0.	\$ 0.		\$ 0.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)

(1) DISCOUNT FACTOR (TABLE A)	14.88	\$ 125000.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 1860000.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-)	YR OC (2)	DISCNT FACTR (3)	DISCOUNTED SAVINGS (+) / COST (-) (4)
1. REPLACEMENT	\$ 992200.	10	.74	734228.
d. TOTAL	\$ 992200.			734228.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 2594228.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS\ ECONOMIC\ LIFE))$  \$ 174610.

5. SIMPLE PAYBACK PERIOD (1G/4) 5.68 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 2594228.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 2.61  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

- Water-saving 1.5 gallon flush.
- Features Pressure-Clean™ flushometer tank system.
- Three-bolt quick connect system with factory-installed tank gasket and bolts.

**K-3458** Wellworth Lite PC Toilet, vitreous china, 1.5 gallon flush. Close-coupled design with elongated bowl. Minimum roughing-in is 12" (305 mm). Tank/bowl combination includes K-4333 bowl, K-4470 vitreous china tank with Kohler 81100 flushometer tank system, K-4471 tank cover and K-9434 chrome-plated trip lever.

**IMPORTANT**—For most satisfactory operation, a minimum static water pressure of 25 P.S.I. is required at the toilet supply inlet.

**Recommended Seats and Supply**  
**K-4650** Lustra™ solid plastic seat with open front and cover.

**K-4652** Lustra solid plastic seat with closed front and cover.

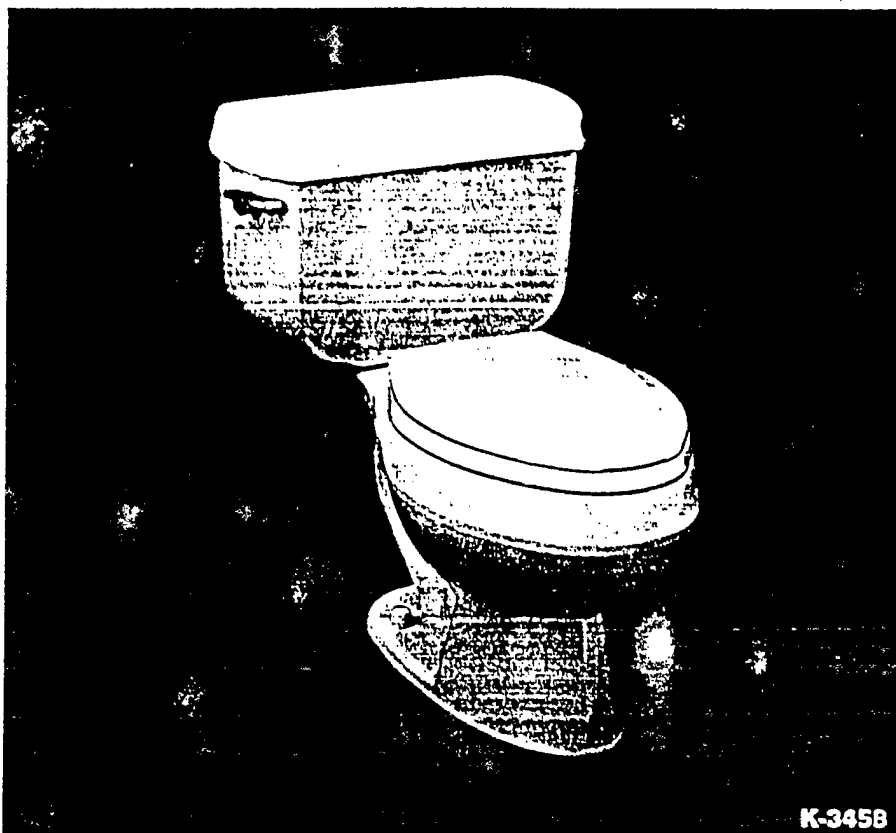
**K-4670-C** Lustra solid plastic seat (K-4681-C Black Black™) with open front and check hinge.

**K-7637** 3/8" angle supply with stop.

**Tank Locks**—Add suffix "-T" to product number.

**Bedpan Lugs**—Add suffix "-L" to product number.

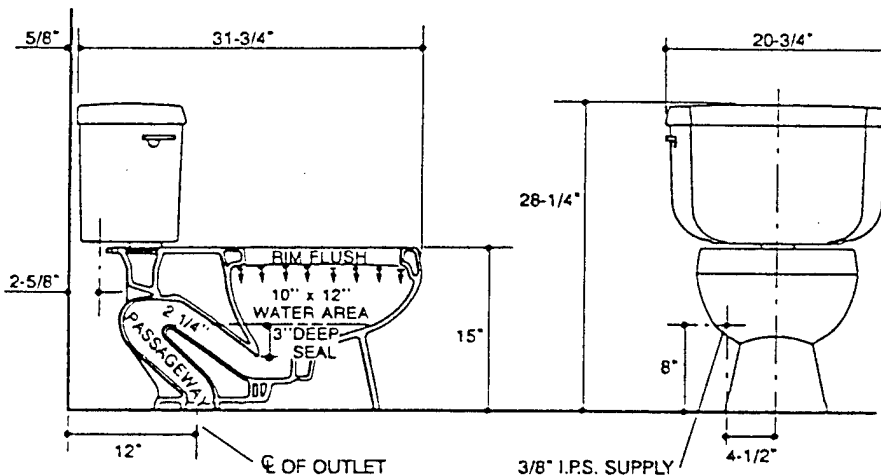
For complete color selection, see Colors section.



**K-3458**

Wellworth Lite PC Toilet and Lustra seat (K-4652) in White.

U.S. Pat. Pending



**KOHLER**

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Estimate:      ECO - 3          Date:      15-Dec-94
Description:   INSTALL WATER CLOSETS - FAMILY HOUSING
Project:      LIMITED EEAP (WTR) Bid Date:
Location:     FORT KNOX, KY    Job #:      94013.03
Sq. footage:  FAM HSG - GP 2   City indx: Louisville, KY
=====

```

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1521801100	ECO - 3 INSTALL NEW WATER SAVING WATER CLOSET, TANK TYPE, FLOOR MNTD, 2PC WHITE W/SEAT, 1.6 GPF					2152.00	Ea.
Unit values		4.02	235.00	114.30	0.00	0.00	349.30
Totals		8651.04	\$505,720	\$245,979	\$0	\$0	\$751,699
U15 MECHANICAL		8652	\$505,720	\$245,979	\$0	\$0	\$751,699

```
=====
Line #      Description
-----
      Manhours  Matl    Labor  Equipment  Sub    Total
=====
```

ESTIMATE TOTAL	8652	\$505,720	\$245,979	\$0	\$0	\$751,699
SALES TAX	0.00%	\$0				
MATL MARKUP	0.00%	\$0				
LABOR MARKUP	0.00%		\$0			
EQUIPT MARKUP	0.00%			\$0		
SUB MARKUP	0.00%				\$0	
TOTAL BEFORE CONTINGENC		\$505,720	\$245,979	\$0	\$0	\$751,699
CONTINGENCY	10.00%					\$75,170
BOND	0.00%					\$0
PROFIT	10.00%					\$75,170
JOB TOTAL						\$902,039

```

=====
Estimate:      ECO - 3          Date:      15-Dec-94
Description:   INSTALL WATER CLOSETS - FAMILY HOUSING
Project:       LIMITED EEAP (WTR) Bid Date:
Location:     FORT KNOX, KY    Job #:      94013.03
Sq. footage:  FAM HSG - GP 2   City indx: Louisville, KY
=====

```

## SUMMARY

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=====
              Manhours   Matl     Labor   Equipment   Sub       Total
=====
U15 MECHANICAL      8652   $505,720   $245,979           $0         $0   $751,699
TOTAL                8652   $505,720   $245,979           $0         $0   $751,699

SALES TAX            0.00%           $0
MATL MARKUP          0.00%           $0
LABOR MARKUP         0.00%           $0
EQUIPT MARKUP        0.00%           $0
SUB MARKUP           0.00%           $0

TOTAL BEFORE CONTINGENC $505,720   $245,979           $0         $0   $751,699
CONTINGENCY          10.00%           $0
BOND                  0.00%           $0
PROFIT               10.00%           $0

JOB TOTAL                                $902,039
=====

```

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										1	2
CALCULATION WORK SHEET 1										DATE:	5 OCT 94
FACILITY NO. :		4456 G		FUNCTION:		UNACCOM PERS HOUS DET FAC TYPICAL OF 278 UNITS					
Occupancy:		FAMILY (2BR)		Operating Hours:		24					
ECO Number	ECO Type	Existing Fixture System		Retrofited Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY			
1	Lavatory Sinks	Description	LPM	Description	LPM		1				
		SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1				
ECO1 TOTAL:											
2	Misc. Sinks	KITCHEN SINK	LPM	NO RETROFIT	9.5	365	1	0			
ECO2 TOTAL:											
3	Water Closets	TANK TYPE	LPF	1.6 GPF TANK TYPE TOILET	6.1	14600	1	0			
ECO3 TOTAL :											
4	Urinals		LPF		LPF	#FL/YR	1	0			
ECO4 TOTAL :											
5	Shower Heads	RESIDENTIAL TYPE	LPM	NO RETROFIT	9.5	245	1	0			
ECO5 TOTAL :											
6	Water	30 GAL A. O. SMITH	TEMP		TEMP		1	0			
	Heater	CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1				
	(GAS)	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1				
ECO6 TOTAL :							1	0			

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 4456 G Water Rate: 0.42 \$/KL Energy Rate: \$/KWH  
Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	Annual Water Saving	LPY	Annual Energy Saving			WATER		Total	Total
ECO Type			ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	0				0	\$0.00	\$0.00	\$0.00	\$0.00
Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	0				0	\$0.00	\$0.00	\$0.00	\$0.00
Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	188,340					\$78.16	\$78.16	\$78.16	\$418.80
Water Closets	0					\$0.00	\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:	188,340					\$78.16	\$78.16	\$78.16	\$418.80
4	0					\$0.00	\$0.00	\$0.00	\$0.00
Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
	0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:	0					\$0.00	\$0.00	\$0.00	\$0.00
5	0				0	\$0.00	\$0.00	\$0.00	\$0.00
Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
	0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:	0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	EST ANNUAL								
Water	HOT WTR				0.89			\$9.37	
Heater	CONSUMPTION				7.70			\$80.96	\$60.00
(GAS)	(LITERS)								
	43,946								
ECO6 TOTAL:	43,946		0	0	9	\$0.00	\$0.00	\$90.33	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

1002

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO. : 4496  
 FAMILY (3BR)  
 FUNCTION: UNACCOM PERS HOUS DET FAC  
 TYPICAL OF 63 UNITS

Operating Hours: 24

ECO Number ECO Type	Existing Fixture System		Retrofited Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
	Description	LPM	Description	LPM			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1	
Lavatory Sinks							
ECO1 TOTAL:							
2	KITCHEN SINK	LPM		LPM		1	0
Misc. Sinks		9.5	NO RETROFIT	9.5	365	1	0
ECO2 TOTAL:							
3	TANK TYPE	LPF	1.6 GPF TANK TYPE TOILET	LPF	#FL/YR 14600	1	0
Water Closets							
ECO3 TOTAL :							
4		LPF		LPF	#FL/YR	1	0
Urinals							
ECO4 TOTAL :							
5	RESIDENTIAL TYPE	LPM		LPM	HRS/YR	0	0
Shower Heads		9.5	NO RETROFIT	9.5	245	1	0
ECO5 TOTAL :							
6		TEMP		TEMP		1	0
Water							
	30 GAL A. O. SMITH						
	CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1	
Heater (GAS)	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1	
ECO6 TOTAL :						1	0

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 4496      Water Rate: 0.42 \$/KL      Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH      Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$418.80
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$78.16	\$418.80
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	Water Heater (GAS)	EST ANNUAL HOT WTR CONSUMPTION (LITERS)				0.89		\$9.37	\$9.37	\$60.00
		43,946				7.70		\$80.96	\$80.96	\$60.00
ECO6 TOTAL:		43,946		0	0	9	\$0.00	\$90.33	\$90.33	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										1002
CALCULATION WORK SHEET 1										DATE: 5 OCT 94
FACILITY NO. : 4859 A		FUNCTION: UNACCOM PERS HOUS DET FAC		TYPICAL OF 129 UNITS						
Occupancy: FAMILY		Operating Hours: 24								
ECO Number	ECO Type	Existing Fixture System		Retrofited Fixture System		Usage	Fixtures	Water Leaks		
		Description	LPM	Description	LPM	HRS/YR	Quantity	Eliminated	LPY	
1	Lavatory Sinks	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1			
ECO1 TOTAL:										
2	Misc. Sinks	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	3		0	
ECO2 TOTAL:										
3	Water Closets	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	7300	2			
ECO3 TOTAL:										
4	Urinals		LPF		LPF	#FL/YR	2		0	
ECO4 TOTAL:										
5	Shower Heads	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	2		0	
ECO5 TOTAL:										
6	Water Heater (GAS)	40 GAL RHEEM IMPERIAL	TEMP		TEMP		2		0	
CAPACITY: 30,000 BTU/H										
RECOVERY: ?										
ECO6 TOTAL:										

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO. : 4859 A Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	Annual Water Saving LPY	Annual Energy Saving			WATER		Total	Total
ECO Type		ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollars Invested	
1	0			0	\$0.00	\$0.00	\$0.00	\$0.00
Lavatory Sinks	0			0	\$0.00	\$0.00	\$0.00	\$0.00
	0			0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:	0	0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	0			0	\$0.00	\$0.00	\$0.00	\$0.00
Misc. Sinks	0			0	\$0.00	\$0.00	\$0.00	\$0.00
	0			0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:	0	0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	188,340				\$78.16	\$78.16	\$838.80	\$838.80
Water Closets	0				\$0.00	\$0.00	\$0.00	\$0.00
	0				\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:	188,340				\$78.16	\$78.16	\$838.80	\$838.80
4	0				\$0.00	\$0.00	\$0.00	\$0.00
Urinals	0				\$0.00	\$0.00	\$0.00	\$0.00
	0				\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:	0				\$0.00	\$0.00	\$0.00	\$0.00
5	0			0	\$0.00	\$0.00	\$0.00	\$0.00
Shower Heads	0			0	\$0.00	\$0.00	\$0.00	\$0.00
	0			0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:	0	0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	EST ANNUAL							
Water	HOT WTR			0.89		\$9.37		
Heater	CONSUMPTION			7.70		\$80.96		\$60.00
(GAS)	(LITERS)							
	43,946							
ECO6 TOTAL:	43,946	0	0	9	\$0.00	\$90.33	\$60.00	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

1002

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO. : 4870 C

FUNCTION:

UNACCOM PERS HOUS DET FAC  
TYPICAL OF 421 UNITS

FAMILY

Operating Hours:

24

Occupancy:

ECO Number ECO Type	Existing Fixture System		Retrofited Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
	Description	LPM	Description	LPM			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1	
Lavatory Sinks							
	SINK W/ AERATOR	11.4	NO RETROFIT	11.4	125	1	
ECO1 TOTAL:							
2	KITCHEN SINK	LPM		LPM	365	2	0
Misc. Sinks							
		11.4	NO RETROFIT	11.4		1	0
ECO2 TOTAL:							
3	TANK TYPE	LPF		LPF	#FL/YR	1	0
Water Closets							
		19	1.6 GPF TANK TYPE TOILET	6.1	7300	2	
ECO3 TOTAL :							
4		LPF		LPF	#FL/YR	2	0
Urinals							
ECO4 TOTAL :							
5	RESIDENTIAL TYPE	LPM		LPM	HRS/YR	0	0
Shower Heads							
		9.5	NO RETROFIT	9.5	245	1	0
ECO5 TOTAL :							
6	40 GAL RHEEM IMPERIAL	TEMP		TEMP		1	0
Water							
	CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1	
Heater							
	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1	
(GAS)							
ECO6 TOTAL :							
						1	0

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 4870 C Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$838.80
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$78.16	\$838.80
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	Water	EST ANNUAL								
	Heater	HOT WTR				0.89		\$9.37	\$9.37	\$60.00
	(GAS)	CONSUMPTION				7.70		\$80.96	\$80.96	\$60.00
		(LITERS)								
		43,946								
ECO6 TOTAL:		43,946		0	0	9	\$0.00	\$90.33	\$90.33	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										1002
CALCULATION WORK SHEET 1										DATE: 5 OCT 94
FACILITY NO.: 5353 F		FUNCTION: UNACCOM PERS HOUS DET FAC		TYPICAL OF 711 UNITS						
Occupancy: FAMILY		Operating Hours: 24								
ECO Number ECO Type	Existing Fixture System		Retrofited Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY			
	Description	LPM	Description	LPM						
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2				
Lavatory Sinks										
ECO1 TOTAL:										
2	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1			0	
Misc. Sinks										
ECO2 TOTAL:										
3	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	14600	1			0	
Water Closets										
ECO3 TOTAL:										
4										
Urinals										
ECO4 TOTAL:										
5	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1			0	
Shower Heads										
ECO5 TOTAL:										
6	40 GAL RHEEM IMPERIAL			TEMP		1			0	
Water	CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1				
Heater	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1				
(GAS)										
ECO6 TOTAL:						1			0	

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 5353 F      Water Rate: 0.42      \$/KL      Energy Rate:      \$/KWH  
 Gas Rate: 10.51      \$/MWH      Demand Rate:      \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$418.80
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$78.16	\$418.80
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	Water Heater (GAS)	EST ANNUAL								
		HOT WTR				0.89		\$9.37	\$9.37	\$60.00
		CONSUMPTION				7.70		\$80.96	\$80.96	\$60.00
		(LITERS)								
		43,946								
ECO6 TOTAL:		43,946		0	0	9	\$0.00	\$90.33	\$90.33	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

## 5 *ECIP PROJECT 3*

*FY94S WATER CONSERVATION STUDY (WATER AND ENERGY), FT. KNOX, KY*

This section contains the project description and the DD1391 forms for ECIP Project FH-3, Family Housing Water Conservation Phase III improvements to 1,268 Family Housing Units. Two lists of the buildings included in the project follow the DD1391 forms. The first list includes all buildings considered in the project in numerical order. The second list shows which buildings were used to model unsurveyed buildings. Following these lists are the LCCID report and the cost estimate for the proposed project. Calculation sheets for the individual buildings follow the project cost estimate. Below is a detailed index of the information included in this section.

DD1391 Form . . . . .	5-2
Table 5.1 ECIP FH-3 - Family Housing . . . . .	5-6
Table 5.2 Buildings Modeled by Surveyed Buildings . . . . .	5-7
Project LCCID Report . . . . .	5-8
Catalog Cut Sheets/Product Information . . . . .	5-9
Project Cost Estimate . . . . .	5-10
Building Calculation Sheets . . . . .	5-13

DATE: 22 December 1994  
PROJECT NO.: ECIP-FH3  
PROJECT TITLE: Family Housing Water Conservation Phase III  
INSTALLATION: Fort Knox  
LOCATION: Kentucky

PRIMARY FACILITY

Water Closets	\$981,000
---------------	-----------

ESTIMATED CONTRACT COST	\$810,000
CONTINGENCY PERCENT (10%)	81,000
SUBTOTAL	891,000
SUPERVISION, INSPECTION & OVERHEAD (5%)	44,550
DESIGN COST	44,550
TOTAL REQUEST	980,100
TOTAL REQUEST (ROUNDED)	\$981,000

Replace water closets in 1268 family housing units with water saving, 6 liters (1.6 gallons) per flush water closets. All water closets will be of the flush tank type. The project will significantly reduce potable water consumption and sanitary waste production.

DATE: 22 December 1994  
PROJECT NO.: ECIP-FH3  
PROJECT TITLE: Family Housing Water Conservation Phase III  
INSTALLATION: Fort Knox  
LOCATION: Kentucky

PROJECT:

Replace water closets in 1268 family housing units with water saving, 6 liters (1.6 gallons) per flush water closets.

REQUIREMENTS:

Fort Knox utilizes inefficient outdated water closets in its family housing units. The existing water closets consume significantly more water and generate greater quantities of sanitary waste per flush than the new standard water saving water closet. The existing inefficient systems place greater demand on the water table, water treatment plant and waste treatment plant. The U.S. Army Corp of Engineers, Louisville District, contracted an Energy Engineering Analysis Program (EEAP) Water Conservation Study of the Post. The study identified energy and water conservation opportunities. Life cycle cost analysis was performed on each opportunity to determine its discounted savings-to - investment ratio (SIR) and estimated payback period. This project has a SIR of 2.24 and a simple payback period of 6.63 years. The project exceeds the minimum requirements of an SIR greater than 1.25 and a simple payback of less than 10 years.

CURRENT SITUATION:

The family housing units at Ft. Knox have inefficient water closets. The family housing units consume more water and generate more sanitary waste than is necessary. The new water closets will greatly reduce the water consumption and waste generated.

IMPACT IF NOT PROVIDED:

If this project is not implemented, 1268 family housing units will continue to consume more water and generate more waste than necessary. The U.S. Army will fail to realize an estimated \$148K in annual savings (FY95\$) and a total discounted savings of \$2.2M during the twenty year life of the project.

ADDITIONAL:

A life cycle cost analysis was performed on the project. The project will realize water savings of over 2.2 times the initial investment cost and will pay for itself in less than 6.7 years.

Ft. Knox is not on the list of installations considered for closure or realignment.

DATE: 22 December 1994  
PROJECT NO.: ECIP-FH3  
PROJECT TITLE: Family Housing Water Conservation Phase III  
INSTALLATION: Fort Knox  
LOCATION: Kentucky

#### SECTION 11 - ECONOMIC ANALYSIS DATA

##### 11D ECONOMIC JUSTIFICATION SUMMARY

This water conservation project is recommended for funding. A life cycle cost analysis was performed on each portion of this project and on the overall project. The overall project will realize water savings of over 2.2 times the initial investment cost and will pay for itself in less than 6.7 years.

TABLE 5.1 ECIP FH-3 - FAMILY HOUSING

5301 A-H	5423 A-D	5548 A-D	5849 B
5305 A-H	5424 A-D	5551 A-H	5850 A-D
5308 A-G	5425 A-H	5551 A-H	5851 A, B
5309 A-D	5426 A-D	5552 A-H	5852 A-D
5312 A-D	5428 A-D	5553 A	5853 A, B
5313 A-D	5429 A-D	5553 B - 5567 B	5872
5314	5430 A-D	5560 A	5873 A - 5885 A, B
5318 A-D	5431 A-D	5562 A - 5577 A	5897 A,B
5319 A-D	5434 A-H	5568	
5324 A-H	5435 A-H	5569 B - 5577 B	
5325 A-H	5437 A-D	5600 AQ	
5328 A-H	5440 A-D	5600 B	
5331 A-D	5443 A-D	5602 A	
5333 A-D	5445 A-D	5602 B - 5641 B	
5335 A-D	5446 AQ-H	5641 A	
5337 A-H	5447 A-H	5642 A-H	
5338 A-D	5448 A-D	5642 A-H	
5339 A-H	5451 A-D	5643 A	
5341 A-D	5452 A-H	5643 B	
5342 A-H	5453 A-D	5644 A-H	
5343 A-D	5455 A-H	5645 A	
5345 A-D	5458 A-D	5645 B	
5346 A-H	5459 A-H	5647 A	
5349 A-H	5460 A-D	5647 B	
5350 A-D	5462 A-D	5648 A-D	
5351 A-H	5464 A-D	5652 A-D	
5352 A-H	5465 A-H	5653 A - 5671 A	
5356 A-H	5467 A-H	5653 B - 5671 B	
5359 A-D	5468 A-D	5661	
5363 A-D	5469 A-D	5700 A - 5701 A	
5369 A-D	5470 A-H - 5475 A-C	5700 B - 5701 B	
5371 A-D	5475	5703 A	
5372 A-D	5475 E-H - 5478 A-H	5703 B	
5402 A-H	5476 A-H	5705 A - 5780 A	
5405 A-H	5480 A-H	5705 B - 5760 B	
5406	5480 A-H	5800 A-D	
5408 A-H	5481 A-D	5801 A, B	
5410 A-D	5482 A-D	5802 A-D	
5413 A-H	5483 A-H - 5491 A-H	5803 A, B - 5817 A, B	
5414 A-D	5486 A-H	5818 A	
5416 A-D	5489 A-H	5818 B - 5747 B	
5418 A-D	5491 A-D	5847 A	
5419 A-H	5493 A-D	5848 A-D	
5420 A-H	5494 A-H	5849 A	

TABLE 5.2 BUILDINGS MODELED BY SURVEYED BUILDINGS

BUILDINGS SURVEYED AND CALCULATED	BUILDINGS ASSUMED TYPICAL OF SURVEYED BUILDINGS
5568	5553B - 5567B, 5569B - 5577B, 5600B, 5602B - 5641B, 5643B, 5645B, 5647B, 5653B - 5671B, 5700B - 5701B, 5703B, 5705B - 5760B, 5818B - 5847B, 5749B
5661	5553A - 5560A, 5562A - 5577A, 5600A, 5602A - 5641A, 5643A, 5645A, 5647A, 5653A - 5671A, 5700A - 5701A, 5703A, 5705A - 5760A, 5818A - 5847A, 5849A
5672	5673A & B - 5685A & B, 5801A & B, 5803A & B - 5817A & B, 5851A & B, 5853A & B - 5897A & B
5314	5308A-D, 5309A-D, 5312A-D, 5313A-D, 5318A-D, 5319A-D, 5331A-D - 5333A-D, 5335A-D, 5338A-D, 5341A-D, 5343A-D, 5345A-D, 5350A-D, 5359A-D - 5363A-D, 5369A-D, 5371A-D, 5372A-D, 5410A-D, 5414A-D, 5416A-D, 5418A-D, 5423A-D, 5424A-D, 5426A-D, 5428A-D, 5429A-D, 5431A-D, 5437A-D, 5430A-D, 5440A-D, 5443A-D, 5445A-D, 5448A-D, 5451A-D, 5453A-D, 5456A-D, 5460A-D, 5462A-D - 5464A-D, 5468A-D, 5469A-D, 5481A-D, 5482A-D, 5491A-D, 5493A-D, 6546A-D, 5648A-D - 5652A-D, 5800A-D, 5802A-D, 5848A-D, 5850A-D, 5852A-D
5406	5465A-H - 5467A-H, 5470A-H - 5475A-C, 5475E-H - 5478A-H, 5480A-H, 5483A-H - 5491A-H, 5494A-H, 5551A-H, 5552A-H, 5642A-H, 5644A-H
5475	
9053*	53014A-H, 5305A-H, 5324A-H, 5325A-H, 5328A-H, 5337A-H, 5339A-H, 5342A-H, 5346A-H, 5349A-H, 5351A-H, 5352A-H, 5356A-H, 5402A-H, 5405A-H, 5408A-H, 5413A-H, 5419A-H, 5420A-H, 5425A-H, 5434A-H, 5435A-H, 5446A-H, 5447A-H, 5452A-H, 5455A-H, 5459A-H, 5476A-H, 5480A-H, 5486A-H, 5489A-H, 5551AQ-H, 5642A-H
	<i>*Surveyed building not included in this project. It is covered under Project Group 1.</i>

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: ECIP-FH3  
LCCID FY95 (92)

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT KNOX      REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: ECIP-FH3      FAMILY HOUSING PROJECT 3

FISCAL YEAR 1995      DISCRETE PORTION NAME: WATER

ANALYSIS DATE: 12-27-94      ECONOMIC LIFE 20 YEARS PREPARED BY: DERRINGTON

1. INVESTMENT

A. CONSTRUCTION COST	\$	891000.	
B. SIOH	\$	44550.	
C. DESIGN COST	\$	44550.	
D. TOTAL COST (1A+1B+1C)	\$	980100.	
E. SALVAGE VALUE OF EXISTING EQUIPMENT	\$	0.	
F. PUBLIC UTILITY COMPANY REBATE	\$	0.	
G. TOTAL INVESTMENT (1D - 1E - 1F)	\$		980100.

2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1994

FUEL	UNIT COST \$/ MWH (1)	SAVINGS MWH/YR (2)	ANNUAL \$ SAVINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
A. ELECT	\$ 46.40	0.	\$ 0.	15.08	\$ 0.
B. DIST	\$ .00	0.	\$ 0.	18.57	\$ 0.
C. RESID	\$ .00	0.	\$ 0.	21.02	\$ 0.
D. NAT G	\$ 10.51	0.	\$ 0.	18.58	\$ 0.
E. COAL	\$ .00	0.	\$ 0.	16.83	\$ 0.
F. PPG	\$ .00	0.	\$ 0.	17.38	\$ 0.
M. DEMAND SAVINGS			\$ 0.	14.88	\$ 0.
N. TOTAL		0.	\$ 0.		\$ 0.

3. NON ENERGY SAVINGS (+) / COST (-)

A. ANNUAL RECURRING (+/-)

(1) DISCOUNT FACTOR (TABLE A)	14.88	\$ 98900.
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 1471632.

B. NON RECURRING SAVINGS (+) / COSTS (-)

ITEM	SAVINGS (+) COST (-)	YR OC	DISCNT FACTR	DISCOUNTED SAVINGS (+) / COST (-) (4)
1. REPLACEMENT	\$ 980100.	10	.74	725274.
d. TOTAL	\$ 980100.			725274.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) / COST (-) (3A2+3Bd4) \$ 2196906.

4. FIRST YEAR DOLLAR SAVINGS  $2N3+3A+(3Bd1/(YRS \text{ ECONOMIC LIFE}))$  \$ 147905.

5. SIMPLE PAYBACK PERIOD (1G/4) 6.63 YEARS

6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 2196906.

7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 2.24  
(IF < 1 PROJECT DOES NOT QUALIFY)

\*\*\*\* Project does not qualify for ECIP funding; 4,5,6 for information only.

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): N/A

- Water-saving 1.5 gallon flush.
- Features Pressure-Clean™ flushometer tank system.
- Three-bolt quick connect system with factory-installed tank gasket and bolts.

**K-3458** Wellworth Lite PC Toilet, vitreous china, 1.5 gallon flush. Close-coupled design with elongated bowl. Minimum roughing-in is 12" (305 mm). Tank/bowl combination includes K-4333 bowl, K-4470 vitreous china tank with Kohler 81100 flushometer tank system, K-4471 tank cover and K-9434 chrome-plated trip lever.

**IMPORTANT**—For most satisfactory operation, a minimum static water pressure of 25 P.S.I. is required at the toilet supply inlet.

**Recommended Seats and Supply**  
**K-4650** Lustra™ solid plastic seat with open front and cover.

**K-4652** Lustra solid plastic seat with closed front and cover.

**K-4670-C** Lustra solid plastic seat (K-4681-C Black Black™) with open front and check hinge.

**K-7637** 3/8" angle supply with stop.

**Tank Locks**—Add suffix "-T" to product number.

**Bedpan Lugs**—Add suffix "-L" to product number.

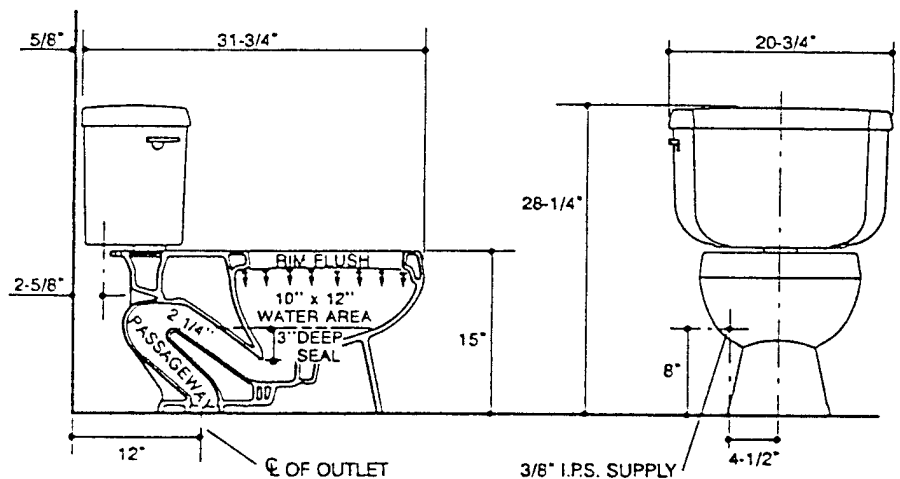
For complete color selection, see Colors section.



**K-3458**

Wellworth Lite PC Toilet and Lustra seat (K-4652) in White.

U.S. Pat. Pending



**KOHLER.**

```

=====
Estimate:      ECO - 3          Date:      15-Dec-94
Description:    INSTALL WATER CLOSETS - FAMILY HOUSING
Project:        LIMITED EEAP (WTR) Bid Date:
Location:       FORT KNOX, KY   Job #:      94013.03
Sq. footage:    FAM HSG - GP 3   City indx: Louisville, KY
=====

```

Line #	Description	Manhours	Matl	Labor	Equipment	Sub	Total
1521801100	ECO - 3 INSTALL NEW WATER SAVING WATER CLOSET, TANK TYPE, FLOOR MNTD, 2PC WHITE W/SEAT, 1.6 GPF					2126.00	Ea.
Unit values		4.02	235.00	114.30	0.00	0.00	349.30
Totals		8546.52	\$499,610	\$243,008	\$0	\$0	\$742,618
U15 MECHANICAL		8547	\$499,610	\$243,008	\$0	\$0	\$742,618

```
=====
Line #      Description
-----
      Manhours   Matl    Labor   Equipment   Sub    Total
=====
```

ESTIMATE TOTAL	8547	\$499,610	\$243,008	\$0	\$0	\$742,618
SALES TAX	0.00%	\$0				
MATL MARKUP	0.00%	\$0				
LABOR MARKUP	0.00%		\$0			
EQUIPT MARKUP	0.00%			\$0		
SUB MARKUP	0.00%				\$0	
TOTAL BEFORE CONTINGENC		\$499,610	\$243,008	\$0	\$0	\$742,618
CONTINGENCY	10.00%					\$74,262
BOND	0.00%					\$0
PROFIT	10.00%					\$74,262
JOB TOTAL						\$891,142

```

=====
Estimate:      ECO - 3          Date:      15-Dec-94
Description:    INSTALL WATER CLOSETS - FAMILY HOUSING
Project:       LIMITED EEAP (WTR) Bid Date:
Location:      FORT KNOX, KY   Job #:      94013.03
Sq. footage:   FAM HSG - GP 3   City indx: Louisville, KY
=====

```

## SUMMARY

```

-----
Manhours  Matl  Labor  Equipment  Sub  Total
=====
U15 MECHANICAL  8547  $499,610  $243,008          $0  $0  $742,618
TOTAL          8547  $499,610  $243,008          $0  $0  $742,618

SALES TAX      0.00%          $0
MATL MARKUP    0.00%          $0
LABOR MARKUP   0.00%          $0
EQUIPT MARKUP  0.00%          $0
SUB MARKUP     0.00%          $0

TOTAL BEFORE CONTINGENC  $499,610  $243,008          $0  $0  $742,618
CONTINGENCY      10.00%                   $74,262
BOND              0.00%                   $0
PROFIT           10.00%                   $74,262
JOB TOTAL                                     $891,142

```

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

10

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO.: 5314 D FUNCTION: UNACCOM PERS HOUS DET FAC  
FAMILY Operating Hours: 24  
Typical of 298 Units

Occupancy:

ECO Number ECO Type	Existing Fixture System		Retrofited Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
	Description	LPM	Description	LPM			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2	
Lavatory Sinks							
ECO1 TOTAL:							
2	KITCHEN SINK	LPM		LPM		2	0
Misc. Sinks							
		9.5	NO RETROFIT	9.5	365	1	0
ECO2 TOTAL:							
3	TANK TYPE	LPF		LPF	#FL/YR	1	0
Water Closets							
		19	1.6 GPF TANK TYPE TOILET	6.1	14600	1	
ECO3 TOTAL:							
4		LPF		LPF	#FL/YR	1	0
Urinals							
ECO4 TOTAL:							
5	RESIDENTIAL TYPE	LPM		LPM	HRS/YR	0	0
Shower Heads							
		9.5	NO RETROFIT	9.5	245	1	55640
ECO5 TOTAL:							
6	40 GAL FURY	TEMP		TEMP		1	55640
Water							
	CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1	
Heater							
	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1	
(GAS)							
ECO6 TOTAL:						1	0

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO. : 5314 D Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$418.80
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$78.16	\$418.80
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	55,640				96	\$23.09	\$1,034.18	\$1,034.18	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		55,640		0	0	96	\$23.09	\$1,034.18	\$1,034.18	\$0.00
6	Water Heater (GAS)	43,946								
		43,946								
ECO6 TOTAL:		43,946		0	0	9	\$0.00	\$90.33	\$90.33	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

10

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO.: 5406 E

FUNCTION:

UNACCOM PERS HOUS DET FAC  
TYPICAL OF 216 UNITS

FAMILY

Operating Hours:

24

Occupancy:

ECO Number ECO Type	Existing Fixture System		Retrofited Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
	Description	LPM	Description	LPM			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2	
Lavatory Sinks							
ECO1 TOTAL:							
2	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0
Misc. Sinks							
ECO2 TOTAL:							
3	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	7300	2	0
Water Closets							
ECO3 TOTAL:							
4		LPF		LPF	#FL/YR	2	0
Urinals							
ECO4 TOTAL:							
5	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	166918.5
Shower Heads							
ECO5 TOTAL:							
6	40 GAL A. O. SMITH	TEMP		TEMP		1	166918.5
Water							
	CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1	
Heater							
	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1	
(GAS)							
ECO6 TOTAL:						1	0

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO. : 5406 E Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$838.80
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$78.16	\$838.80
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	166,919				289	\$69.27	\$3,102.50	\$3,102.50	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		166,919		0	0	289	\$69.27	\$3,102.50	\$3,102.50	\$0.00
6	Water	EST ANNUAL								
	Heater	HOT WTR				0.89		\$9.37	\$9.37	\$60.00
	(GAS)	CONSUMPTION				7.70		\$80.96	\$80.96	\$60.00
		(LITERS)								
		43,946								
ECO6 TOTAL:		43,946		0	0	9	\$0.00	\$90.33	\$90.33	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

10

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO.: 5475 D

FUNCTION:

UNACCOM PERS HOUS DET FAC  
TYPICAL OF 255 UNITS

FAMILY

Operating Hours:

24

Occupancy:

ECO Number ECO Type	Existing Fixture System		Retrofitted Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
	Description	LPM	Description	LPM			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2	
Lavatory Sinks							
ECO1 TOTAL:		LPM		LPM		2	0
2	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0
Misc. Sinks							
ECO2 TOTAL:		LPF		LPF	#FL/YR	1	0
3	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	7300	2	
Water Closets							
ECO3 TOTAL:		LPF		LPF	#FL/YR	2	0
4							
Urinals							
ECO4 TOTAL:		LPM		LPM	HRS/YR	0	0
5	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	0
Shower Heads							
ECO5 TOTAL:		TEMP		TEMP		1	0
6	40 GAL A. O. SMITH						
Water							
	CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1	
Heater							
	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1	
(GAS)							
ECO6 TOTAL:						1	0

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 5475 D Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	Annual Water Saving LPY	Annual Energy Saving			WATER		Total	Total
ECO Type		ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	0			0	\$0.00	\$0.00	\$0.00	\$0.00
Lavatory Sinks	0			0	\$0.00	\$0.00	\$0.00	\$0.00
	0			0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:	0	0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	0			0	\$0.00	\$0.00	\$0.00	\$0.00
Misc. Sinks	0			0	\$0.00	\$0.00	\$0.00	\$0.00
	0			0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:	0	0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	188,340				\$78.16	\$78.16	\$78.16	\$838.80
Water Closets	0				\$0.00	\$0.00	\$0.00	\$0.00
	0				\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:	188,340				\$78.16	\$78.16	\$78.16	\$838.80
4	0				\$0.00	\$0.00	\$0.00	\$0.00
Urinals	0				\$0.00	\$0.00	\$0.00	\$0.00
	0				\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:	0				\$0.00	\$0.00	\$0.00	\$0.00
5	0			0	\$0.00	\$0.00	\$0.00	\$0.00
Shower Heads	0			0	\$0.00	\$0.00	\$0.00	\$0.00
	0			0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:	0	0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	EST ANNUAL							
Water	HOT WTR			0.89			\$9.37	
Heater	CONSUMPTION			7.70			\$80.96	\$60.00
(GAS)	(LITERS)							
	43,946							
ECO6 TOTAL:	43,946	0	0	9	\$0.00	\$90.33	\$90.33	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

10

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO.: **5568 B**      FUNCTION: UNACCOM PERS HOUS DET FAC  
 Occupancy: FAMILY (3BR)      Operating Hours: 24  
 TYPICAL OF 188 UNITS

ECO Number ECO Type	Existing Fixture System		Retrofited Fixture System		Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
	Description	LPM	Description	LPM			
1	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2	
Lavatory Sinks							
ECO1 TOTAL:							
2	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0
Misc. Sinks							
ECO2 TOTAL:							
3	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	7300	2	
Water Closets							
ECO3 TOTAL:							
4		LPF		LPF	#FL/YR	2	0
Urinals							
ECO4 TOTAL:							
5	RESIDENTIAL TYPE	5.68	NO RETROFIT	5.68	245	1	0
Shower Heads							
ECO5 TOTAL:							
6	40 GAL STATE	TEMP		TEMP		1	0
Water							
	CAPACITY: 33,500 BTU/H	334	REDUCE STORAGE TEMP	322	8760	1	
Heater							
	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1	
(GAS)							
ECO6 TOTAL:						1	0

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 5568 B Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$838.80
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$78.16	\$838.80
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	Water	EST ANNUAL								
		HOT WTR				0.89		\$9.37		
	Heater	CONSUMPTION				7.70		\$80.96		\$60.00
	(GAS)	(LITERS)								
		43,946								
ECO6 TOTAL:		43,946		0	0	9	\$0.00	\$90.33	\$90.33	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										10
CALCULATION WORK SHEET 1										DATE: 5 OCT 94
FACILITY NO.:		5661 A		FUNCTION:		UNACCOM PERS HOUS DET FAC				
Occupancy:		FAMILY (3BR)		Operating Hours:		TYPICAL OF 188 UNITS				
						24				
ECO Number	ECO Type	Existing Fixture System		Retrofited Fixture System		Usage	Fixtures	Water Leaks		
		Description	LPM	Description	LPM	HRS/YR	Quantity	Eliminated LPY		
1	Lavatory Sinks	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2			
ECO1 TOTAL:										
2	Misc. Sinks	KITCHEN SINK	13.2	NO RETROFIT	13.2	365	1	0		
ECO2 TOTAL:										
3	Water Closets	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	7300	2	0		
ECO3 TOTAL:										
4	Urinals									
ECO4 TOTAL:										
5	Shower Heads	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	0		
ECO5 TOTAL:										
6	Water	CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1	0		
	Heater	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1			
	(GAS)									
ECO6 TOTAL:							1	0		

## CALCULATION WORK SHEET 2

FACILITY NO.: 5661 A Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	Annual Water Saving LPY	Annual Energy Saving			WATER	Total	Total
ECO Type		ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollars Invested
1	0			0	\$0.00	\$0.00	\$0.00
Lavatory Sinks	0			0	\$0.00	\$0.00	\$0.00
	0			0	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:	0	0	0	0	\$0.00	\$0.00	\$0.00
2	0			0	\$0.00	\$0.00	\$0.00
Misc. Sinks	0			0	\$0.00	\$0.00	\$0.00
	0			0	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:	0	0	0	0	\$0.00	\$0.00	\$0.00
3	188,340				\$78.16	\$78.16	\$838.80
Water Closets	0				\$0.00	\$0.00	\$0.00
	0				\$0.00	\$0.00	\$0.00
ECO3 TOTAL:	188,340				\$78.16	\$78.16	\$838.80
4	0				\$0.00	\$0.00	\$0.00
Urinals	0				\$0.00	\$0.00	\$0.00
	0				\$0.00	\$0.00	\$0.00
ECO4 TOTAL:	0				\$0.00	\$0.00	\$0.00
5	0			0	\$0.00	\$0.00	\$0.00
Shower Heads	0			0	\$0.00	\$0.00	\$0.00
	0			0	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:	0	0	0	0	\$0.00	\$0.00	\$0.00
6	EST ANNUAL						
Water	HOT WTR			0.89		\$9.37	
Heater	CONSUMPTION			7.70		\$80.96	\$60.00
(GAS)	(LITERS)						
	43,946						
ECO6 TOTAL:	43,946	0	0	9	\$0.00	\$90.33	\$60.00

SYSTEMS CORP

Systems Engineering and Management Corporation, Knoxville, TN

FY94S EEAP FT. KNOX WATER CONSERVATION STUDY										1
CALCULATION WORK SHEET 1										DATE: 5 OCT 94
FACILITY NO.:		5672 A		FUNCTION:		UNACCOM PERS HOUS DET FAC				
Occupancy:		FAMILY		Operating Hours:		TYPICAL OF 151 UNITS				
						24				
ECO Number	ECO Type	Existing Fixture System		Retrofited Fixture System		Usage	Fixtures	Water Leaks		
		Description	LPM	Description	LPM	HRS/YR	Quantity	Eliminated LPY		
1	Lavatory Sinks	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	1			
ECO1 TOTAL:										
2	Misc. Sinks	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0		
ECO2 TOTAL:										
3	Water Closets	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	14600	1	0		
ECO3 TOTAL:										
4	Urinals									
ECO4 TOTAL:										
5	Shower Heads	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	0		
ECO5 TOTAL:										
6	Water Heater (GAS)	40 GAL RHEEM IMPERIAL			TEMP		1	0		
		CAPACITY: ?	334	REDUCE STORAGE TEMP	322	8760	1			
		RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1			
ECO6 TOTAL:							1	0		

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 5672 A Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving	Dollar Saving	Dollars Invested
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
3	Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$418.80
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$78.16	\$418.80
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00
6	Water Heater (GAS)	EST ANNUAL								
		HOT WTR				0.89		\$9.37		
		CONSUMPTION (LITERS)				7.70		\$80.96		\$60.00
		43,946								
ECO6 TOTAL:		43,946		0	0	9	\$0.00	\$90.33	\$90.33	\$60.00

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

10

## CALCULATION WORK SHEET 1

DATE: 5 OCT 94

FACILITY NO.: 9053 B

FUNCTION:

UNACCOM PERS HOUS DET FAC  
TYPICAL OF 327 UNITS

Operating Hours:

24

FAMILY

ECO Number ECO Type	Existing Fixture System Description	LPM	Retrofitted Fixture System Description	LPM	Usage HRS/YR	Fixtures Quantity	Water Leaks Eliminated LPY
1 Lavatory Sinks	SINK W/ AERATOR	9.5	NO RETROFIT	9.5	125	2	
ECO1 TOTAL:							
2 Misc. Sinks	KITCHEN SINK	9.5	NO RETROFIT	9.5	365	1	0
ECO2 TOTAL:							
3 Water Closets	TANK TYPE	19	1.6 GPF TANK TYPE TOILET	6.1	7300	2	0
ECO3 TOTAL:							
4 Urinals		LPF		LPF	#FL/YR	2	0
ECO4 TOTAL:							
5 Shower Heads	RESIDENTIAL TYPE	9.5	NO RETROFIT	9.5	245	1	55640
ECO5 TOTAL:							
6 Water	40 GAL RUUD #P40-7			TEMP		1	55640
Heater	CAPACITY: ?	345	REDUCE STORAGE TEMP	322	8760	1	
(GAS)	RECOVERY: ?		INSTALL INSUL JACKET	322	8760	1	
ECO6 TOTAL:						1	0

**SYSTEMS CORP**

Systems Engineering and Management Corporation, Knoxville, TN

# FY94S EEAP FT. KNOX WATER CONSERVATION STUDY

2 OF 2

## CALCULATION WORK SHEET 2

FACILITY NO.: 9053 B Water Rate: 0.42 \$/KL Energy Rate: \$/KWH

Gas Rate: 10.51 \$/MWH Demand Rate: \$/KW

ECO Number	ECO Type	Annual Water		Annual Energy Saving			WATER		Total	Total	Dollars Invested
		Saving	LPY	ELEC KW	ELEC KWH	GAS MWH	Dollar Saving	Dollar Saving			
1	Lavatory Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
ECO1 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
2	Misc. Sinks	0				0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
ECO2 TOTAL:		0		0	0	0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
3	Water Closets	188,340					\$78.16	\$78.16	\$78.16	\$838.80	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
ECO3 TOTAL:		188,340					\$78.16	\$78.16	\$78.16	\$838.80	\$0.00
4	Urinals	0					\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
		0					\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
ECO4 TOTAL:		0					\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
5	Shower Heads	55,640				96	\$23.09	\$1,034.18	\$1,034.18	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
		0				0	\$0.00	\$0.00	\$0.00	\$0.00	\$0.00
ECO5 TOTAL:		55,640		0	0	96	\$23.09	\$1,034.18	\$1,034.18	\$0.00	\$0.00
6	Water Heater (GAS)	EST ANNUAL HOT WTR CONSUMPTION (LITERS)				1.75		\$18.35	\$18.35	\$60.00	\$0.00
		43,946				7.70		\$80.96	\$80.96	\$60.00	\$0.00
ECO6 TOTAL:		43,946		0	0	9	\$0.00	\$99.31	\$99.31	\$60.00	\$0.00

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